JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXXX., No. 2711.] TUESDAY, APRIL 27, 1915. [67TH YEAR.

EDITORIAL NOTES.

A Chief Engineership—and the Man.

THE invitation of the South Metropolitan Gas Company for applications for the position of Chief Engineer (as published in our advertisement columns to-day), contains one paragraph that is very striking. "Candidates," it says, "must "have a sound knowledge of mechanical engineering, and "have had experience in the management of an engineering "undertaking—not necessarily gas producing." The last words are particularly significant. They show that the Chairman and Directors of the Company are not going to confine themselves to the limits of the gas industry in making selection of a successor to Mr. Doig Gibb, who is shortly to vacate the position under circumstances explained last week. The quoted paragraph accentuates one thing and suggests another. The matter accentuated is the important part that mechanical engineering now takes in gas-works operations —so important that, under the circumstances of the Company, the Directors put, as essential accomplishments of their Chief Engineer, a thorough knowledge of mechanical engineering and experience in the management of engineering works, and not only so, but they put them before qualifications in constructional gas engineering and gas manufacture. The point suggested by the paragraph is that the Directors are not altogether certain that they will be able to secure the man they require from within the gas industry itself, and so have not restricted to the industry the field from which to make selection.

The advertisement indirectly raises the point of whether the chief engineer of a gas undertaking should be imperatively a gas-trained man, or one with primarily mechanical engineering training, but with an aptitude to accommodate himself to altogether new surroundings, and to "pick up" by study and association the thousand-and-one details of technical and commercial supervisory and advisory duties and responsibilities. Without hesitation, it may be said a gas-trained man is imperative in the ordinary circumstances of a gas-works. But the circumstances of works so large as those of the South Metropolitan Company are different. The works are separated into stations; and each station has a thoroughly trained gas engineer and manager in charge. This, of course, lessens the need for the new chief having at the outset an intimate technical knowledge of gas engineering, management, and manufacture. Is it easier, however, for the trained gas engineer to broaden his knowledge of mechanical engineering than for the trained mechanical engineer to enter a gas-works, and start at the very beginning to gain knowledge of the special technical and commercial work of the gas industry? *Primâ facie*, we should imagine that it would be easier for the former to extend his knowledge of mechanical engineering, if the opportunities for doing so were available. But it is a question whether the gas engineer who has not been thoroughly trained in mechanical engineering would be likely to afterwards exert himself specially in that direction, seeing that so much of the mechanical plant used in gas-works is of standard type, and is readily obtainable from the makers. Incidentally, it may be noticed that the advertisement does not confine applicants to those who have had experience in mechanical engineering works identified with the gas industry. On the other hand, the thoroughly trained mechanical engineer would have to accommodate himself to his new, and perhaps altogether strange, surroundings, and perseveringly apply himself to become their master, in order to advantageously put to use his prior knowledge. It may, however, be taken for granted that the man who comes up to the South Metropolitan Company's requirements for a Chief Engineer will be one who will not regard the exploitation of a fresh field and the mastering of the details and intricacies of the technical work of a large gas undertaking as presenting any insuperable difficulty, and will soon ascertain whether or not his previous knowledge will enable him to bring about fresh adaptations in the causes of economy and efficiency.

The vacant position is bound to attract many candidates. But we hope that, although the Company are proposing an innovation in respect of such an important office, in the result and for the reputation of the gas-engineering profession, the verdict of the Directors will show that in the ranks of specialized gas men they have been able to discover the man they want. The Chief Engineership of the Company is one of the "plums" of the profession; we do not want to see it taken away from it. Of course, it may be said that the ultimate choice of the Directors will not necessarily prove that they have the best man, or that, if they go outside the gas profession, their policy is the correct one. Time alone can furnish satisfactory proof. It is, however, hoped that a very strong and successful effort will be made by gas-trained engineers to win the position for their own profession. Two Chairmen of the South Metropolitan Company have reached the ultimate position *viâ* the Chief Engineership; and both of them had, at any rate, the larger part of their technical training upon gas-works. Is it to be said that the gas industry is not to-day yielding as it did in years past good men for the highest position? It would be an invidious thing for the Chairman of the Company to answer the question; and we should not ask or expect him to do so. If he did reply, no doubt he would say that, between the days of his training and the present ones, the order of things has so vastly changed in the industry that, judged by to-day's standards of the requisites in a Chief Engineer, his own training could have usefully been extended. If, however, all that is being done now to specially equip men for the very best positions in the gas industry, is failing in its purpose, then there is still something wrong or deficient in our methods of training, which should be put right. In considering this point, one cannot help reflecting that the Company went North for their retiring Chief Engineer, and to the Midlands for an Engineer for the East Greenwich station. The question may, therefore, be fairly asked, Has the line of internal production of properly equipped officers for the chief positions suddenly ended? If so, this is one respect in which the South Metropolitan Company have not looked well ahead; for if the Company, with all their resources and opportunities, cannot produce right men for the high positions in the gas profession, what is to be said? Surely not that the Company's standards of official qualification are higher than the home capacity for production. Of course, we do not believe anything of the kind. Lord Kitchener has been at the head of the War Office almost from the opening of the war; yet the Government have been strongly accused of not having looked sufficiently forward in respect of the demand for the munitions of war. The advertisement of the South Metropolitan Company may be fairly read as an open confession of something. If the Company expect other gas undertakings or engineering establishments to prepare men for the highest official position at their disposal, they too should "return the compliment," and take a hand in the responsible work.

Coal Carbonization and Industrial Development in South Wales.

THERE was a conference at Cardiff last Tuesday and Wednesday on the subject of trade development in South Wales; but whether any practical good will issue from it depends wholly upon those engaged in the important local industries. South Wales having been richly endowed by Nature with coal, and coal constituting the very base of its industries, the attention and thoughts of those participating in the conference were chiefly directed to the utilization, in the ways which will return the largest yield in profit, of the part of the native raw product which undergoes carbonization. This seems the line of work that will best repay consideration

in South Wales; for, by all accounts, there is much waste going on, the prevention of which would be a valuable economy. From the papers read, one is exceedingly doubtful as to whether South Wales is the best possible portion of the country in which to establish altogether new industries —new for South Wales—which would draw upon the products of the carbonization of the local coal for raw material. The reason for this doubt is that industries such as chemical and the synthetic colour and drug industries must naturally thrive best where raw material of the right and richest quality is plentiful.

The papers on coal carbonization and the bye-products were contributed by Mr. W. J. Atkinson Butterfield (who was there through Mr. George Clarry, the General Manager of the Cardiff Gas Company), Mr. T. G. Watts, B.Sc., and Mr. R. H. Greaves, M.Sc. All the papers contain a mass of information on the products of coal carbonization; but the complaint was made during their discussion that nothing was put forward in any one of them in the nature of a specific practical scheme of development. It hardly came within the province of the authors, nor were they qualified, to offer a concrete scheme which could be adopted or rejected by those concerned. The papers were intended to be directive and suggestive rather than anything else, by showing what is done elsewhere—Germany was the only comparison—in the way of production from coal, and the development of industries and trade from the products and their derivatives. With these facts before him, it is a question for the practical manufacturer to consider whether in Wales there is any chance of successful constructive work in building-up fresh industries on the products resulting from the carbonization of the local coal, and so enjoy a part of a large trade that has been in the possession of others. It is held by Mr. Butterfield that the district, with the great advantage of cheap fuel and good ports, is as well situated as any in the United Kingdom for the establishment of chemical industries, and utilizing the products of coal distillation as the raw material. Cheap fuel and good ports are not the only considerations. There is the coal itself; and it is perfectly clear from what Mr. Watts said in his paper that, comparatively and competitively, South Wales in this matter of the establishment of new industries on the coal carbonization industry would not stand in the strongest of positions. Put one simple question as a test. Why is it the bye-product coke-oven has obtained relatively small application in South Wales? The answer is that the coals contain a comparatively low amount of volatile matter. And further, the coals possess several peculiarities affecting their transference into coke. One is that very high temperatures are required for their carbonization; and another is that the transitory expansion to which the charges are subject during the coking period means that great care must be exercised in the selection of plant, with structural details suitable in character for the special coking characteristics of the coal. The yields of certain products, too—benzol for example—are not up to the levels attained in the coking of coals in other fields. In these circumstances, it would appear quite impossible for an ultimate economy and profit to be shown which would be comparable with coking plants elsewhere; and thus South Wales would start off at relatively a disadvantage.

In all three papers, however, there is good encouragement for the coking industry to do better than hitherto. Mr. Butterfield and the other authors make it abundantly clear that there is very considerable scope for development in the larger adoption of bye-product recovery plants, as also in securing from them the highest yields possible, so as to realize the fullest value from the coal. What does this mean? It means starting at the proper place—that is, the beginning, and not talking of the development of new industries until other work has been done. There is no practical use in putting the cart before the horse. It appears plain, from what was said in the papers and during the discussion, that the South Wales colliery and coke-oven proprietors have not hitherto overburdened themselves with systematic research with the view to improvement and development. All three authors advocated well-equipped laboratories and the utilization of the services of properly trained men—men encouraged by decent pay—to investigate and probe thoroughly and continuously with the view to raising the economic and fruitful results of present processes, and to search for new openings for profitable work under the conditions of South Wales raw material. This is one of the secrets of the success of Germany in the coal-carbonizing and chemical industries, though not possessing such rich coal as we have in certain of our own fields. But the attitude of British coal and coking plant owners and of manufacturers, in major part, is well represented by the remark of one speaker in the discussion, that a small tax on the output of coal would provide an ample sum for experiments; and there would be no difficulty in this, providing the industry were assured of value being received. Always the same short-sighted attitude! Who is to know if value will be received, until sufficient enterprise allows adequate and persistent investigation to take place? Do the coal people and the owners of bye-product coking plant in South Wales think that a prior assurance of value being received was the way that the synthetic colour and drug industries of Germany, and other industries in that country, were built up? In this one respect we cannot help admiring the broad and large enterprise of our arch-enemies, and equally we feel somewhat ashamed of the parsimony and dwarfed views that keep back developments in this country in those very directions in which Germany is so strong.

There is plenty of work to be done, plenty of improvement to be made, in obtaining maximum yields and good quality —whether it be in briquette making, coke, sulphate of ammonia, or tar. Unless we improve the quality of certain of these things, we shall see a continuation after the war of what the papers read at Cardiff show had attained large proportions prior to the war, or had set in with obvious vigour. With improved quality of product, Germany's system had been to capture markets near home, leaving to this country the more distant ones, and therefore the less economical to supply. They have a coal inferior to ours, and in normal times they buy largely from us. But their enterprise extends to making the best possible of their own coal by all means available, so as to gain at the price the satisfaction of external consumers. The export coal business commenced with the Baltic and North Sea ports, and then the Mediterranean ports were attacked. For coke we have a comparatively small export trade; and it is almost stationary. Germany's export trade in coke has been large, and was increasing rapidly. We ought any way to secure a large proportion of the coke trade Germany was doing before the war with France and certain other countries. The same effective methods were adopted by Germany when they commenced the exploitation of sulphate of ammonia abroad. Good quality, and sale to the countries near home, with gradual expansion outwards—leaving this country with the more remote markets, which, of course, in time Germany intended to attack. Likewise with the coke-briquette trade, which Germany has developed to a wonderful degree and at a remarkable rate. Truly, if the three papers are read in the proper light, if their lessons are studied with care, and are not lost upon the South Wales manufacturers, it will be seen by them that there is large scope for work on immediately available lines, without aspiring to industries at the present time for which they are not altogether suitably or economically equipped, mainly through the characteristics of the local coal, the major part of which has a special and valuable serviceability unmatched by the coal of differing properties in other areas, which too have their special uses. The papers ought to form a starting-point for fresh development; but there can only be development by pursuing the proper road.

The National Spirit and its Non-Existence in Places.

THERE was a peculiar fitness in the speech of the Prime Minister at Newcastle-on-Tyne last Tuesday evening for all engaged in any capacity in every industry in the country. If the spirit permeating the speech is imbibed by those—whatever the industry or their place in industry—who were not previously animated by it, and the result is conversion to a larger view from the narrow one of self-interest, Mr. Asquith will have done a considerable service—exceeding his immediate intention and probably expectation. The intention was not to accuse of remissness or slackness (as misinterpretation of other speeches has suggested there has been), but to put forward the case as to the necessity, owing to the enormous expenditure of ammunition and prospective requirement, of a largely increased supply, and to appeal to every man, without class distinction, to do his very best part in, according to lot and circumstance, assisting in the war, and in lightening the hour of the nation's greatest need. This, said the Premier, is the nation's war; and no man is

worthy the name of British citizen who is not taking his share in it. Part cannot be taken by all in the firing-line, on the high seas, or in the air; nor can a share be taken by all in the making of munitions of war. But everyone can take part by, in his circumstances, working up to his best level, and by exercising the individual power he possesses, so as to help the country and his fellows to the utmost extent. It is not helping the nation, it is not taking the part of the British citizen, to augment unnecessarily the burdens of the country, as, for example, the coal and the shipping people have been doing, by causing additional expense to fall on the community, in order that an intemperate selfishness may have full satisfaction.

There is such interlinking and such interdependence between industry and industry, and between the people and industry, that nothing but national co-operation in every conceivable way, and sacrifices by every individual, can produce the best results in carrying through the war, and in meeting the conditions of an emergency which is indescribable in full detail and ramification. Between men, masters, and taxpayers, there must be give and take—a mutuality of sacrifice. Mr. Asquith summarized the necessary sacrifices of masters, of men, and of State under three heads: (1) Limitation of profits; (2) temporary suspension of restrictive rules and customs; and (3) provision of reasonable compensation in cases of proved injury or loss. If limitation of profits is right for the companies and firms devoted to the production of munitions and other material required in connection with the war, the same principle should apply to certain other industries of the country. Those industries that are working hardest and at greatest pressure to provide material for the war—the gas industry is taking its part—should not be singled-out for profit limitation while certain other highly essential ones run riot, and so cause (as in the case of the misdirected operations of the coal and shipping interests) higher cost of material required by the industries directly producing munitions, or contributing necessaries to their production. Statutory gas companies have their profits limited; and the shareholders of gas companies working under a sliding-scale, in addition to heavier taxation of profits, are suffering severely from the increased costs of materials, largely due to profits being demanded in excess of what they would be if the coalowners and shippers were possessed by the national spirit, and were guided by the principle of mutuality of sacrifice in relation to the war, and the emergency of the country. "As to the war," said the Prime Minister, "I believe we shall all agree that the firms "and companies who are supplying the State with munitions "of war should not be entitled thereby to make undue or "abnormal profits out of the war." We are confident, in view of Mr. Asquith's references to the "nation's war" and the "national spirit," and his appeal for common sacrifice, that he did not intend that, outside the manufacturers of munitions of war, there should in these times exist the right to "undue or abnormal profits." Such a position would be unthinkable and inconsistent. It should be the duty of the Government, in organizing and mobilizing the industrial and productive resources of the country, to look beyond the industries actually and immediately engaged in the making of munitions of war to those that can hinder those industries or else unnecessarily add to their costs and those of the community, and bring them likewise under regulation, and under tribute to the general and necessary economy.

To the workers of the country, the sacrifice demanded is not a serious one for them to make. Restrictive regulations and customs, which perhaps are quite legitimate under normal conditions, should be suspended while the war lasts. Restrictions and customs of the order in view will not fit in with present circumstances; and principles that are peculiar to trade unionism can well be held in abeyance, and be revived after the war so far as they are requisite to the rightful ends of the workers' organized efforts. In some quarters—numerically small quarters compared with the whole of the skilled and unskilled workers of the country—action to secure ends has been taken during the war which has shown a shameless disregard for those fighting and risking their lives abroad. In a few other cases, there have been disputes and interruptions of service, which have added to local inconvenience. But the major portion of the workers of the country have been loyal to it, and to the part they have to perform—whatever that part may be—in its service. They have realized the need for the work of every man's hand; they have realized the exceptional character of the times; they have realized that such exceptional times require from each and all exceptional service. We have had information from several gas undertakings—it has been a pleasure to have it—that the numerous gaps made in the ranks by the response to the call to arms have been almost compensated by the splendid energy of those left behind.

The question of compensation by the State to those who, without default of their own, suffer through the transfer of their labour to work upon munitions, and to those who by their inability to carry out civil contracts through the conversion of their works to supply the needs of the State, is one which does not need emphasis here to force home the justice of the scheme for obviating undue loss through compulsory service—a compulsion which will be in most cases accompanied by a whole-hearted willingness. While this is a matter upon which comment is unnecessary, there are other words in Mr. Asquith's speech the quotation of which will form an appropriate conclusion to the line taken in the present article. On a wall in every office into which there have flowed undue and abnormal profits, owing to the opportunities provided by the war and not simply to the changing conditions in times of international peace, and on a wall in the house of every worker who has taken part in any proceeding to interfere with the smooth running of the national machinery in these times, these words from the lips of the Prime Minister should occupy a conspicuous place: "The "appeal is made, not to one class more than another, but "to every man individually who has hereafter to render his "account to his fellow-countrymen, to his children, to his "own conscience, of the part which he played and the "share of the common burden which he took upon his "own shoulders when the fortunes, not only of Great "Britain, but of European freedom, were at stake." Anyway we hope that colliery owners, coal dealers, and shipowners more especially will make a note of the appeal, and act upon it.

The Desires of the Coal Owners and Miners.

It will be seen from statements in another column that the leading electrical papers have spoken favourably of the suggestion emanating from the Lancashire Commercial Section of the Manchester District Institution of Gas Engineers, that there should be a joint meeting of representatives of the gas and electricity industries, with the view of endeavouring to force upon the Government the urgency of serious steps being taken to relieve the country and its industries of the peril in which they stand in regard to coal supplies, prices, and transmission from the collieries. It ought to be manifest to the Government that there is very little to be gained by courteous *pourparlers* between the Board of Trade and representatives of the coal interests. Outward evidence is completely absent as to the report of the Departmental Coal Committee having had any effect on the coal proprietors; and for all the notice they have openly taken of it, or by a receding movement, it might as well not have been issued, save for public edification. Certain it is the coal people are not a bit abashed. They go about their lucrative business in the same old way, utilizing the opportunities provided by the crisis in the fortunes and lives of nations—our own nation prominently among them—for making the utmost penny out of the people and industry. The President of the Board of Trade had a conference with a number of coalowners last week; and subsequently a resolution was passed by the latter which does not denote any particular strength of attitude towards easement. It reads: "This meeting of coalowners, having a desire to "moderate the prices of coal for home consumption, as far "as may be practicable in the interest of the country, recom-"mend that the question of the prices of such coal be con-"sidered by coalowners in the various districts with this "object in view." It can certainly be said that the "desire" had not a pre-existence of any duration in view of the circulated recommendation of the Midland coalowners a week earlier, that the contract price of gas coals should be put up 5s. or 6s. per ton throughout the country—a matter to which attention was drawn by us last week, and upon which Mr. H. E. Jones made indignant remark at the meeting of the Bombay Gas Company, as reported elsewhere in this issue. Judging from the past, and from what has occurred in relation to coal prices and the juggling with coal contracts during the war months, the prospects of a happy issue for the country from the resolution of the coalowners are not of the brightest, unless remorse has seized upon the

latter, and they have decided to now begin to show their patriotism through the powerful position they occupy. We hope there is sincerity in the coalowners' "desire," and that it will bear fruit. But the "Iron and Coal Trades Review" does not give much hope, as in an editorial article on contracts with merchants (this may have been written before the interview with Mr. Runciman, but was not published until last Friday) it says: "Generally speaking, collieries "will *insist* on advances of 5s. to 6s. per ton, according to "the basis prices." These figures are also the ones recommended by the Midland owners.

Another matter in which gas undertakings have interest is mentioned in the same article. Gas and electricity suppliers are not by any means the only buyers who have been deprived of full deliveries of scheduled quantities under contracts, in order that coalowners and certain factors might have extra coal to place on the open market at the high prices ruling. The "Iron and Coal Trades Review" defends this action, in the case of coal supplied to merchants under contract. It points to diminished output from collieries, and then says: "If collieries had not made a proportionate reduction in contract quantities, they would have "had literally nothing to place on the open market at the "high prices ruling. From the coalowners' point of view, "it may fairly be asked—why should they, on account of "men going to the war, be deprived of the tonnage they had "reserved for the open market, and by supplying merchants "with full contract quantities give them further opportunities of making handsome profits?" Contracts are contracts, and not mere "scraps of paper." And here we have the "Review" unblushingly admitting that, although there was coal by which contracts could have been fulfilled, the owners were justified in keeping part back—for what purpose? In order that they might share in the "handsome "profits" that were to be made in the open market—largely through the enforced purchases by people who had made provision for supplies by contract with these men. According to the report of the recent Coal Committee, the owners anyway share in any accession of retail profits. But, like Oliver Twist, they want more; and, by withdrawing part of the contract quantities, they can make more. It can be well understood that, if coalowners and certain factors are not moved by the desire to use their position to help the country by restraint in regard to profits, they will not be altogether pleased with intervention to bring them to a sense of their duty. It is somewhat doubtful whether anything less than Government regulation will make the coal people see they owe a duty to the country, to themselves as men and Britishers, and not exclusively to their own pockets. It is not a pleasant thing to have to say this. But there is past experience of prices, there is the Board of Trade Committee's report, and now the "Review" says that prices will be "considerably higher" next winter if the conditions are anything like last one.

It is not anticipated that, although at the moment there appears to be a sort of deadlock over the demand of the miners for a national conference with the coalowners in reference to the proposed 20 per cent. war bonus, it will end in open rupture and a strike. The men themselves, other than a proportion of the men of South Wales, are against any action which would be prejudicial to the country in the present emergency; and, this being so, there is more likelihood of greater public sympathy in looking from all points of view at the request of the men—perhaps not up to 20 per cent., because, as Mr. Asquith says, all have got to make some sacrifice in this war. The men appear determined, however, not to have the question dealt with by the District Wages Boards, but nationally. They evidently did not get much encouragement from Mr. Runciman at their interview with him on Wednesday, seeing that they immediately afterwards sought an interview with Mr. Asquith, who was rather inclined to side with the owners' view that the District Wages Boards were the proper arbiters in this matter. But a second attempt was made to enlist the sympathy of the Premier in favour of calling a national conference of the owners and miners to settle the bonus question, with what success will be probably known by the time this is published. Is it likely that such a conference would end in settlement? We fear not. The miners, however, were not satisfied with the differences made in rates of pay when the District Wages Boards were set up; and it is clear that what they want is that the maximum war bonus obtainable shall apply equally to the whole country. There is no question about it that the miners, being deprived by their manhood and patriotism and the claims of the war from using as a weapon the national strike to enforce their demand, the Government will have to see this thing through to a clean-cut finish.

Benzol from Gas.

There is a point in Mr. W. J. Atkinson Butterfield's paper, read at the Trade Development Conference at Cardiff last week, and referred to in an earlier column, which may be emphasized. He has for some time past taken an interest in the question of depriving town gas of some of its benzol in order to provide additional motor fuel. We know what is being largely done at present, and not always with prebenzolized wash-oils, so as to obtain toluol from gas. Mr. Butterfield says it has been ascertained by practical trials that at least one-third of the benzol content of coal gas as produced at gas-works at the present day can be abstracted from gas without reducing its calorific value below the standard of 500 B.Th.U. per cubic foot. In 1912, there were upwards of 16 million tons of coal carbonized at the gas-works of the United Kingdom; and the extraction of only one-third of the benzol would mean a yield of 12 million gallons of benzol from the whole of the gas-works. It is just likely that the processes that have been put in operation at gas-works at the instance of the High Explosives Committee will not terminate in all cases with the war.

Trade Union Levies.

When a man joins a trade union, he may be letting himself in for more than he guesses at the moment. Generally it is necessary to follow the course officially adopted, whatever it may be; but this does not invariably prove to be the case. Levies, for instance, have on more than one occasion proved a source of discord; and much time has been taken up in the Courts over their discussion. There has now been an addition to the number of these legal contests in which the dissenting trade unionist has proved successful; the decision in this case having been given by the Courts in Scotland. The trouble arose over a resolution to levy 1s. per member for three years towards the support of a certain newspaper. The Union concerned was the United Society of Boiler-makers and Iron and Steel Shipbuilders; and a boiler-maker living at Port Glasgow, not choosing to hand over his money for this purpose, sought a declaration that the resolution was illegal and invalid, and that any investment of funds of the Society in shares of the newspaper proprietors was also illegal. Obviously, the levy in dispute did not come within any of the provisions contained in the rules; but it was argued that the action of the Society was lawful under one of the rules which provided that all questions affecting the general interests of the Society not dealt with in the rules, must be submitted to a vote, and must have a majority of the votes recorded before taking effect. This rule, however, did not appear to the Judge to have anything to do with a levy or to warrant any levy being made. With regard to the purchase of the newspaper shares referred to out of the funds of the Society, this, too, was found to be unauthorized by the rules—his Lordship expressing the opinion that, in the circumstances in which the newspaper company were placed, "the purchase could not be regarded in any proper sense of the term as an investment." The Executive Committee, he added, appeared to have considered the purchase as a judicious expenditure of the Society's funds; but this, of course, was a different thing from an investment of the funds. Reference was made to another case involving another society, in which Mr. Justice Warrington had to consider whether a purchase of shares in the same company was a lawful investment of the funds of a trade union. In that action, also, a conclusion was come to adverse to the point of view of the union. These decisions are well worth bearing in mind by trade unionists who may be anxious that there should not be too wide a distribution of their money. In the Scotch case Counsel have still to be heard on the question as to the parties liable in repayment of the £1000.

Reference has already been made in the "JOURNAL" to the adoption of a calorific standard of 500 B.Th.U. per cubic foot for gas in Japan. In noticing the matter, we expressed the hope that the "gross" value would be taken; and this has been done.

PERSONAL.

Early this month, at St. Jude's Church, Southsea, the marriage was celebrated of Lieut. S. P. THORNTON, of the 10th Leicesters (brother of Mr. H. M. Thornton, J.P., of the Richmond Gas Stove Company), and Miss MAY DAVIES. The officiating clergyman was the Bishop of Sierra Leone. Captain Emmerson acted as best man, and many other officers were present at the ceremony and the reception.

Mr. JOHN MEIKLEJOHN, Works Manager to the York Town and Blackwater Gas Company, who has for some time been anxious to join the army, has now prevailed upon his Directors to release him. He has, therefore, joined as a driver in the Mechanical Transport Section of the Army Service Corps. It is gratifying to learn that, by thus offering his services to his country, Mr. Meiklejohn will, through the generosity of the Directors, suffer no pecuniary loss.

The marriage has recently taken place of Mr. JOHN H. DONALDSON, Engineer to the Sevenoaks Gas Company, and Miss EDITH A. CATT, the only daughter of Mr. Charles F. Catt, Secretary of the Tunbridge Wells Gas Company. Among the many presents received by the happy couple were a silver salver from the Directors and a silver sugar dredger from the staff of the office and works of the Tunbridge Wells Gas Company, and a silver tea service from the Directors and a silver cruet and salts from the staff and employees of the Sevenoaks Gas Company.

At a meeting of the Huddersfield Town Council last Wednesday, approval was given to the recommendation of the Gas Committee that Mr. H. SINGLETON, Draughtsman and Chemist, should be appointed Engineer and General Manager of the gas-works for a period of twelve months, at a salary of £250 per annum. Mr. Singleton succeeds Mr. Booth, who has secured an appointment as Gas Engineer in the South of England. Mr. E. S. APPLEYARD has been appointed Commercial Manager of the works for a period of twelve months; while Mr. J. CROSLAND has been given the post of Distribution Superintendent for a like period. The Gas Committee have decided to advertise for a Draughtsman and Chemist at a salary of £100 a year.

Mr. H. C. TURNER, who has been continuously with the Davis Gas-Stove Company, Limited, since 1874, has recently retired on a well-merited pension. He was presented by the Board, last Friday week, with a silver tea service and tray, and Mrs. Turner was the recipient of a silver chain handbag. Other presents have been received by them both from the several departments of the firm. It is interesting to note that Mr. Turner designed the first "Davis" gas-cooker, and for the past few years has held the position of Chief Engineer to the Company. Mr. JOHN SUGG (a nephew of the late Mr. William Sugg) has been appointed Chief Engineer to the Company, to succeed Mr. Turner. In his new capacity, Mr. Sugg will have entire charge of the Company's gas apparatus department.

OBITUARY.

The death occurred recently at Herne Bay, at the advanced age of ninety-four, of Mr. WILLIAM W. BOX, who was for many years Manager of the Crayford works of the West Kent Gas Company. He will be remembered by some of the older readers of the "JOURNAL" in this capacity, but probably by more for the retort-lid with which his name is associated. He joined the British Association of Gas Managers in 1871; but his membership ceased in 1889.

The "Journal für Gasbeleuchtung" of the 10th inst. reports the deaths last month of two prominent gas engineers. After a severe illness, Herr KARL GRAUMANN, the Manager of the Bonn Corporation Gas, Water, and Electricity Works, died on the 25th ult. He studied at the Technical College at Carlsruhe from 1887 to 1890, and entered the service of the Bonn Corporation in 1908. Two days later, Herr OTTO HELCK, the Manager of the Carlsruhe Corporation Gas, Water, and Electricity Works, died suddenly from an operation following an attack of appendicitis. Deceased, who had barely completed his 49th year, had studied at the Carlsruhe Technical College, and at the end of his course remained there 2½ years as assistant. In 1892 he entered the Carlsruhe Gas-Works; in 1897, he was made Works Inspector; and in 1900, Works Manager of the No. 2 Works. In 1910 he was appointed Manager of the gas, water, and electricity works of the town.

North of England Gas Managers' Association.—The annual meeting of this Association will be held next Saturday, in the Gas Office, Newcastle-on-Tyne, under the presidency of Mr. Thomas Waddom. The statement of accounts and the names of candidates for membership will be submitted. We learn from the circular issued by the Hon. Secretary and Treasurer (Mr. Herbert Lees, of Hexham) that the Committee will make two recommendations—viz., that a donation of £10 10s. should be contributed to the Benevolent Fund of the Institution of Gas Engineers, and that the officers and Committee should be retained in their respective positions for one year longer than the period for which they were originally elected. The only technical business will be a paper by Mr. W. Diamond, of Marley Hill, on "The Recovery and Fractionation of Benzol Products from Coal Gas."

NOTES FROM WESTMINSTER.

SINCE the Easter Holidays, Parliament has been sitting only three days a week; but this does not debar Select Committees sitting, if they choose, on the other days, if there is work to be done. But the war is plainly having its effect upon Private Bill proceedings. Nobody seems to be desirous of opposing if mutual concessions produce satisfaction on the main issues; and promoters generally have shown a disposition to resign some of the ground of their applications rather than enter on a battle in the Committee rooms. This is in consonance with the desire of the Government that there should be as little contentious business as possible during the war. The result is that many Bills that at one time were threatened with a long journey to the Statute Book have taken the short cut *viâ* the Unopposed Committee rooms. There is absolutely nothing to report regarding the progress of Gas Bills, save that the unnecessary—unnecessary in view of the general prohibition without sanction—Treasury clause regarding capital expenditure is being inserted in Bills without exception, and that those promoters who prefer a level 500 B.Th.U. (total heat) standard, instead of the Model Clause 540 B.Th.U. one, with a 7½ per cent. margin, are being allowed to have their own way. The Northwich Gas Company have made considerable modifications in their Bill, in the face of antagonism which it was not considered worth while encountering just now. The Company have relinquished the site that they had pegged-out in the Bill for new gas-works; and they have also given up the proposed conversion from a maximum to a sliding-scale basis. A possible coming event casts its shadow before in the shape of the agreed insertion of a purchase clause.

Gas Bills.

Yorkshire Electric Power Bill.

The Bill promoted by the Yorkshire Electric Power Company is being opposed by a number of gas companies, and by those local councils with electric undertakings whose opportunities of territorial expansion will be for ever curtailed if the general powers asked for by the Company are granted, and are exercised. The Company at the present time can only supply for power (the power customers being able to use up to 20 per cent. for lighting purposes) and in bulk to distributing authorities. They want permission to supply for lighting in the undeveloped districts in their extensive area; but they are proposing to put themselves altogether beyond the legislation that generally applies to electricity, to which the Board of Trade, as well as the opponents, have raised objection. The Company ask for roving powers, and to be allowed to pick and choose their districts—taking the most promising, and leaving derelict the others so far as electricity supply goes. Full option is what they want. For no district is the usual area defined within which, in a given time, there must be provision for supply. The Company desire the powers in perpetuity, subject to a clause which, since the Bill was lodged, has been inserted to satisfy some of the local authorities, to the effect that if the Company do not supply any area within five years, application can be made by other intending suppliers for powers and for annulling the powers of the Company. The Company are asking much at the hands of Parliament; and the Board of Trade anyway are strongly unfavourable to conferring such large authorization in this uncustomary form. The Bill is now before a Lords Committee; and the cool request of the promoters is accompanied by a total indifference to the provision of evidence as to the necessities of any district in regard to which they are asking for powers. The Board of Trade think the proper course for the Company to pursue is to apply for a Provisional Order for particular districts as and when they are prepared to take in hand their supply. In this way each case could be discussed on its merits, and ordinary provisions could then be applied. Hinging on this is the case of the gas companies opposing. They are not in the least afraid of ordinary competition; but they do object, while under the general statutory restrictions applying to gas supply, to have to compete with an electric supply company not under the general statutory restriction applying to the electricity industry. There is nothing unfair in the gas companies' attitude. The Company, it must be admitted, have found the road long and tedious to a small dividend paying state; and the war has come, and has again thrown things much out of gear. But these conditions are not sufficient reason for giving the Company preferential statutory powers. The London electricity power schemes having gone for this session, this is the most imposing electricity measure now before Parliament.

Water in Parliament.

Water Bills are, with but few exceptions, floating through without much trouble. The preamble of the Metropolitan Water Board Bill has been passed. Other Bills have been before the Unopposed Bills Committee, and have gone forward. The Barnoldswick Bill is now well on its way; a question as to compensation water having been adjusted, in terms which will be found in the reference to the measure in our "Parliamentary Intelligence." The South Staffordshire Water-Works Company's Bill was before a Committee of the House of Lords last week; but decision has been reserved until the conclusion of the proceedings on the Wolverhampton Corporation Water

Bill, which is before the same Committee. There is a dispute between the Company and the Corporation as to a certain area from which it is proposed to extract water. The matter will be further referred to when the result of the contest is known.

ELECTRICITY SUPPLY MEMORANDA.

In the "Yorkshire Observer" the other day, there appeared an article, destined for public edification, headed "Electricity in the Home: The Advantage of Cleanliness." The writer of the article, it is evident, knows well the electrical side of the story; he professes, through his statements, not to have the barest acquaintance with the gas side.

Things the Public Ought to Know.

The general character of the article reminds us that there are things upon which the public should be better informed than they are at present, in order to counteract this type of article—things which require prominence, and not be obscured by being buried away in a mass of other matter. The article first tells the portion of the public which the "Yorkshire Observer" reaches, that the fact that electric light is now "commonly used" in streets, shops, and warehouses is sufficient evidence that it may be regarded as the best means of providing artificial illumination in the home. That is not true. The major part of street lighting is still done by gas—high and low pressure. The minor extent to which the electric light is being used is largely due not to illuminating efficiency and reliability for street lighting purposes, but to the large possession of electricity supply undertakings by municipal bodies, who are the road-lighting authorities. On the point of reliability, if a gas-lamp fails (which is a very rare occurrence), it is only a lighting unit in an area; but if the electric light fails, it generally means the plunging of several streets into darkness—perhaps all the streets electrically lighted. As to shop lighting, there are two reasons why in some main thoroughfares electric lighting some few years ago obtained such a hold—one was fashion; the other (at the time) convenience. Both are affected by the modern trend—the trend of scientific illumination. The hold secured by electricity for large shop window lighting was in the days of the carbon filament lamp, which was not nearly such an eye-irritating source of illumination as the modern metallic filament lamp. Confessedly, there was something artistic in having sources of lights dotted about here and there among the goods—so long as they were not in contact, and flexibles were undamaged, and so fairly safe from promoting conflagrations, which they do on occasion without giving any notice of their fell intention. But with the coming of metallic filament lamps, with their high intrinsic brilliancy, a new order of things has set in. Gradually shopkeepers are learning that dazzling sources of light within the range of vision of possible customers are not the best means of allowing inspection, by all sorts and conditions of eyesight, of the goods displayed in the windows. Scientific illumination urges the placing of the lamps at the top part of the windows, and illuminating the goods by reflected light. This change in situation, and in the work to be performed, makes the inverted gas-lamp, with its rich downward diffusion of light, a suitable method of illumination; and by it, for coloured goods, an excellent white light is obtained.

Continued.

Because electricity has obtained a partial adoption for the lighting of streets, because electric light became at one time the vogue for some shop windows, do not constitute sufficient reasons for a general assertion that it is the "best" system of lighting for the home. There are other considerations. The writer of the article in the "Yorkshire Observer" intimates that economy, as expressed by actual cost, is not the only question. It is largely the question that matters now and always with the mass of the people. There are other things, he holds, which should be considered. We quite agree. Cleanliness and hygiene, he says, should not be overlooked. Again we agree. In the case of the writer of the "Memoranda," small units of inverted gas-lamps maintain his rooms in such clean condition that the length of time he is able to keep the house decorator outside his doors makes him almost ashamed to meet that worthy, until sanitary considerations suggest giving him a job. As to hygiene, our "Yorkshire Observer" friend treads on dangerous ground. There are different aspects of the hygienic question. Quality of light is a matter of importance to the public. They ought to be told more about it. High intrinsic brilliancy light sources are eye injuring. Which has the highest intrinsic brilliancy—a metallic filament lamp, or an incandescent gas-lamp? The writer in the "Yorkshire Observer" should inform the public as to the wide difference there is between the two; and of the absolute necessity that exists, where there are children, and for the preservation or protection of the eyes of adults, for the filaments of metallic electric lamps to be shielded. Then there is such a thing as composition of light. Do the public, as a matter of fact, understand this? Do they know that gaslight is not to be excelled in the matter of a composition approaching nearly to that of natural light? So far it is seen that the writer in the "Yorkshire Observer," employing the art of omission, did not inform his readers of all there is to be told about the relative properties of the two lights. But he does say something in support of his case which shows defective intelligence in regard to the subject. "Since," he writes, "there is no actual combustion on the production of light by the incandescent electric lamp, vibration of the atmosphere consequent upon the formation of products of combustion is entirely avoided." How remarkable! Here is a man, pretending to be an educator of the public on matters electrical, advocating stagnation of the atmosphere in rooms—something against which our hygienists have been frequently preaching of late years, and something against which there has been sharp protest by some of the members of the Institution of Electrical Engineers in connection with their own lecture theatre. The small bunsen flames of domestic gas-burners creating movement in the atmosphere, offer the simplest of means and the best of systems of promoting ventilation, and so motion of the atmosphere. Another point is made as to the tarnishing of metal goods—of course, the idea desired to be impressed is that, where there is the electric light, such goods will not tarnish. Even our brass door-knocker gets tarnished, and that is in the open air—the common source of fresh-air supply for both electric and gas lighted houses. The metal goods in the writer's gas-lighted rooms do not get any more tarnished than the metal goods in a neighbour's electric-lighted rooms. Then it is not true that "electric light to-day should cost but one-third of what it did five or six years ago." With the carbon filament lamp, there was great need for economy; and the bad light that was given at a high expense was fast turning people who had adopted those lamps back to incandescent gas lighting. Now that the more economical metallic filament lamp has come, people are employing larger units, and the necessity for shielding the filaments and so partly obscuring the light, are two factors combining to upset the "one-third cost" fallacy.

Electric "Fires" and Tariffs.

The same writer has something to say about what he names electric "fires"—meaning thereby what are called "hot-bar" electric-radiators. The old lamp form of electric-radiator is dismissed with the statement that "the results by it were neither very successful nor encouraging." But the "hot-bar" radiator, "for comfort and actual heating capacity," is "not surpassed by any coal or gas fire in existence." Practically the same thing was electrically said long, long ago of the lamp form of radiator. Neither for comfort nor heating capacity can the hot-bar radiator come up to a modern gas-fire on equal cost terms. The writer does not say anything about actual cost. All he does say is that electricity is now supplied in most towns of any importance at as low as ½d. per unit for domestic purposes; and at this price electric-fires are most economical in use. Both of these statements are untrue. In the industrial section of the "Electrician" the other day, a writer (who is never averse to accusing gas men of being lost to all sense of truth) asserted that the gas interests "*seem* to take a delight in accusing electrical men of deliberate intent to deceive the public where residence tariffs are under consideration." It is not a question of what they "seem" to do; the question is what they actually do. Just preceding this point, he remarks: "When the rates for electrical energy are discussed in connection with heating and cooking apparatus, and the price of ½d. per unit is mentioned, the extra primary charge should also be introduced, but always as also covering the lighting supply." But this is precisely what the electrical writer in the "Yorkshire Observer" does not do. He tells the public that electricity is supplied in most towns of any importance as low as ½d. per unit for domestic purposes; and he omits all reference to the primary charge. On the point of this charge covering the lighting supply as well as cooking and heating, Mr. W. R. Cooper recently showed—quite unintentionally—that, by the operation of a primary charge and a secondary charge per unit, he is getting his lighting supply on preferential terms compared with the man who does not approve of electrical cooking, or the man who is paying on a flat-rate for lighting only—current used for lighting in both cases being "corresponding" supplies, the same as "power" supplies in the Long Eaton case. In other words, because a man cooks and heats by electricity, he ought not to get his lighting on better terms than a man who is an equally good customer for lighting, but who prefers to cook and heat by some other method, any more than a power consumer who uses electric light is not allowed to have his power supply at a cheaper rate than another equally good power consumer. However, to return for one final remark to the writer in the "Yorkshire Observer," he declares that "electric-fires may now be obtained from 20s. each, in art metal finishes or in coloured porcelain enamel, in different patterns to suit the style or period of the room." Would this gentleman guarantee the internal construction of these twenty shilling electric-fires and their good conduct in maintaining their original external appearance? Do for goodness sake be not only fair but sensible in presenting the case for electricity to the public! We have seen not a few of these cheap, shoddily built radiators that have been an eyesore after almost the first use.

Street-Lighting Abatements.

In connection with the street-lighting restrictions, it transpired a short time since that in London some of the Borough Council Electricity Committees had pleaded for, and Electricity Companies had stuck-out for, their "full pound of flesh" under their public lighting contracts. How

the companies who did not want to make any abatement have got on we do not know; but generous consideration was shown to the borough electricity committees by their colleagues. The gas companies did make full allowance for gas unconsumed. The question of abatements has been raised elsewhere. But the reductions that are being offered are either extremely mean ones, or the extent of the street electric lighting is very small. The Electricity Company supplying Chelmsford are perhaps the most liberal in the amount of their offer. They are making a rebate of £112 in respect of the lamps not lighted during the quarter ending Dec. 31. The Corporation are going to purchase the gas-works! The Oulton Broad Electricity Company have offered a discount of 10 per cent. on the account for the period the street-lamps have not been lighted. The Council, however, think a larger abatement ought to be made; in fact, their inclinations are towards total exemption. The Cleveland and Durham Company supply such electric lighting as Hartlepool possesses in the streets; and they have offered a reduction of £25 per quarter for the December and March periods, and £10 per quarter for the June and September periods. The Town Council have accepted the proposal; but the figures quoted are not very fat ones, though probably commensurate with the street-lighting business. But there is trouble at Chichester. At the advent of the Electric Light Company there, the Council not only welcomed it, but encouraged it with patronage to the fullest possible extent. The friendship at the moment is not exactly of the most intimate order. The Council asked for a reduction of the charge for public lighting, owing to the less number of lamps in use; but the Company point out that the increased cost of generating the public lighting units since the war has amounted to £267, against which the saving effected by the Company in street lighting does not exceed £70. The Council are holding-back the payment until some arrangement has been come to. Of course, the Directors of the Company fail to find any legal or other justification for the action of the Council. There is a little soreness existing in the old city to-day between the two bodies.

Audi Alteram Partem.

Some of our electrical contemporaries know how to be extremely one-sided. At the request of Mr. George Wilkinson, the Electrical Engineer of Harrogate, they published the letter which he sent to the "JOURNAL," and which was published by us on April 6. The writer of that letter accused us of having "grossly misrepresented" him. In consequence of the circulation given by them to this statement, the Editor of the "JOURNAL" asked the papers to publish the reply that we made to Mr. Wilkinson; but the sense of fairplay of two of them is marked by the fact that they have declined to do so. We had imagined them above such petty prejudice and preferential treatment. An accusation was made against us which at the request of an electrical engineer they published; justice alone should have given the accused the right to an equally prominent hearing. The Editors of the "Electrical Review" say: "We do not consider the matter of sufficient interest to reproduce the lengthy note in full." The essential part of the "lengthy" note would not have occupied more than a third to half a column of our contemporary's precious space, columns of which are sometimes taken up by subjects that we suppose they "consider" of great importance, but upon which some other people hold very contrary opinions. The "Electrician," which also published Mr. Wilkinson's letter, finds escape from the annoyance it is just possible that gentleman might have felt by the publication of our reply by saying: "We think it best to refer any interested readers to the issues of our contemporary dated the 6th and 13th inst."

The "E. T." Does, and Makes a Mistake.

The "Electrical Times" is the only paper that does give space to the substance of our reply to Mr. Wilkinson. Our contemporary appears to entertain doubt as to whether our Harrogate friend, in his remarks at the meeting of the Institution of Electrical Engineers, really made reference to the fact that the 12-gallon electric water-heater, thermostatically controlled to 180° Fahr., was equal to 60 gallons per day at 100° Fahr. It remarks that Mr. Wilkinson "certainly stated that the electric water-heater fitted up at his house had a capacity of 12 gallons, but whether he added, *as no doubt he intended*, that it is equal to an output of 60 gallons per day at 100° Fahr. is not quite clear from his letter. The 'JOURNAL' assumes that he made this amplification; but his letter may be read in two ways, and certainly none of the technical papers reported the statement." Our contemporary says it is "actually the case" that the thermostat is set for 100° Fahr. Who is responsible for this priming? The "Electrician" report said the electricity supply was "knocked off" at 180° Fahr. The "Electrical Review" report stated that Mr. Wilkinson "now used a 12-gallon electric water-heater, thermostatically controlled, which gave a hot water supply at 180° Fahr. night and day." If the thermostat is "actually" set for 100° Fahr., there seems here to be another misstatement for Mr. Wilkinson to rectify. Now the "Electrical Times" adds that there is an emergency heating element included with this 12-gallon (1 KW.) water-heater which can be switched-on when an additional supply of hot water is needed quickly, and, "as Mr. Wilkinson points out, his heater, if it be required, can furnish daily ten times the amount mentioned." Where did Mr. Wilkinson point this out? All he claimed in his letter to us, and which our electrical contemporaries published, was that the heater was "equal to an output of over 60 gallons of water per day at 100° Fahr."—not that it was equal to ten times that amount. He added: "I have *facilities* [method of heating not mentioned] for the production of ten times this amount of hot water if necessary, *but the output of the heater is found ample for ordinary everyday demands*." Now why does the "Electrical Times" go out of its way to assert something regarding this wonderful 12-gallon 1 KW. water heater, which the evidence of Mr. Wilkinson's own pen refutes? This fact removes the intended sting from the concluding lines of our contemporary's comment, to the effect that we were jumping to conclusions which were certainly amusing. It seems, however, that it is our contemporary that is jumping to conclusions; and as evidently it is under a "wrong impression," perhaps Mr. Wilkinson will now make the necessary correction. This gentleman appears to be very unfortunate in getting himself properly represented in the electrical papers over this matter of his 12-gallon electric water-heater.

THE SUGGESTED JOINT GAS AND ELECTRICITY CONFERENCE ON THE COAL QUESTION.

Support from the Electrical Press.

REGARDING the suggestion that there should be a "mass" meeting of representatives of the gas and electricity interests in London to urge upon the Government more serious action in regard to the supply of coal during the war (including the matters of price and sea and rail conveyance), the electrical journals give it their cordial support. The idea originated with the Lancashire Commercial Gas Section; and it was confirmed at the recent conference of the members of the Manchester District Institution of Gas Engineers (over which Mr. J. G. Newbigging presided). The resolution was published last week (p. 144), and the matter was then also the subject of editorial comment.

In the course of its reference to the matter, the "Electrical Review" observes:

> We cordially welcome the suggestion, and trust that it may be quickly carried into effect. Recent articles in our columns have indicated the difficulties that are being met with by electricity works; and, unless strong action is taken, there is every likelihood that these difficulties will become more acute, very much to the detriment of the industry. It rests with the Council of the Institution of Electrical Engineers to take the first step towards holding a National Conference; and station managers who desire relief from the present burden, and safeguards against additional burdens, ought to lose no time in pressing their views upon that body by letter and by personal representations to its members.

Among other remarks, the "Electrician" says:

> We are glad to note that the Manchester District Institution of Gas Engineers has passed a resolution suggesting a conference of gas and electricity undertakings to consider what action shall be taken in regard to the high cost of coal. The subject is most important. . . . The situation, it seems to us, can only be met by Government action, with a view to the limitation of profits under war conditions. . . . The question of the price of coal, on which the well-being of the community depends so largely, both individually and collectively, is not one which can be left to be taken up some time next autumn when still higher prices will be looming in the immediate future. It is a question which should be taken up with the least possible delay; for it is one that is urgent, and advantage should be taken of the smaller production permitted by summer weather to obtain reserves and to take suitable action. We gather that both the Board of Trade and the Home Office have the matter under consideration; but we should like to see more activity. Under the circumstances, we hope that the electricity undertakings will come together and discuss the subject with the gas undertakings, with a view to bringing pressure upon the Government to take immediate action. This is a case in which we think something might be done by the Institution of Electrical Engineers, for there seems to be no other body that can take action quickly, and no association which deals merely with electricity supply on "non-party" lines.

The "Electrical Times" writes:

> Our esteemed contemporary, the "JOURNAL OF GAS LIGHTING," this week contains some interesting proposals. It believes that the time has arrived for electrical and gas men to combine their forces in approaching the Government departments, who are said to be treating coal consumers in a very off-handed manner. . . . It has been proposed that a large joint meeting be held in London. Our contemporary suggests that whatever is to be done must be done quickly. Possibly the Hon. Secretary of the I.M.E.A. may start the ball rolling on our side?

Mr. E. J. Wellens, of Hebden Bridge, points out that he was not the operator who took the photographic group of members of the Yorkshire Junior Gas Association on the occasion of their visit to his works last Saturday week—see *ante*, p. 143. Mr. Westerman, of Hebden Bridge, was responsible for arranging and taking the group, as also for the views of the plant that appeared last week and in the number of the "JOURNAL" for Oct. 7 last year.

EXTENSION OF BRITISH TRADE.

By One who was at Cardiff Last Week.

THE Conference on the Extension of British Trade which was held last week in Cardiff, and of which a report of the proceedings, in so far as they bore on matters of interest to the gas industy, is given on other pages of this issue of the "JOURNAL," was the outcome of a movement on the part of the Cardiff Corporation to extend the industrial activities of the city and district in directions in which German manufacturers have hitherto taken the lead. The arrangements for the Conference had been made jointly by the Technical Schools Committee and the Development Committee of the City of Cardiff, acting through Mr. John J. Jackson, Director of Education, and Mr. Charles Coles, the Superintendent of Technical Instruction; and they reflected great credit on the organizing abilities of these gentlemen.

The Conference was spread over two days; the sessions taking place on successive afternoons in the spacious lecture hall of the South Wales Institute of Engineers. At the first session, four addresses were presented for discussion; all dealing with questions of interest to gas men. Prints of the addresses having been circulated beforehand with the invitations to the Conference, no time was lost in reading them; and, after the authors had made a few introductory observations, Councillor J. Stanfield, who presided, declared the addresses open for discussion. Professor H. E. Armstrong, who had prepared the opening address, railed in his genial manner at our commercial methods, the general average of intelligence in the country, our educational system, our utilization of coal, our agriculturists' failings, and our neglect of research. No one can be more entertaining as a destructive critic than Professor Armstrong; but it is difficult to regard his diatribes seriously, or to look to him as a guide in constructive work, whether of an educational or an industrial character. He delights to make caustic comments on the labours and views of professorial colleagues in the scientific world—one of whom of the highest distinction was lampooned by him at Cardiff. And yet, in almost the same breath, he blames the rest of the community for neglecting to seek advice and guidance from scientific men. In fact, his efforts lead no whither; and his Cardiff audience for the most part seemed to feel this.

The address of Professor Armstrong was followed by one by Mr. T. G. Watts, B.Sc., of the Great Western Colliery Company, on "Coke-Oven Bye-Products," which proved to be a useful review of the present position of bye-product recovery, and of the special difficulties in the way of applying recovery to ovens coking South Wales coals. These difficulties mostly have their centre in the relatively low proportion of volatile matter in these coals. Mr. Watts, however, throughout his paper pressed the question of the use of coke-oven gas for town-gas supplies; and in his advocacy of such use quite overlooked some substantial disabilities of coke-oven supplies. For instance, when comparing the respective advantages of the regenerative and the waste-heat types of coke-oven, he pointed out that with the former there remained some 4000 cubic feet of surplus gas per ton of coal carbonized; and he added that "gas *per se* may be transported in pipe-lines to any distance, stored for any length of time, and yet in no way deteriorate in quality." In making this statement, which academically is true, Mr. Watts ignored economic considerations of the highest importance, which, in fact, render the statement ridiculous from the industrial standpoint. Mr. Watts must surely know that storage of gas for any length of time is a practical impossibility. The holders on gas-works merely serve to equalize the differences between the rates of production and the rates of consumption of gas at different hours of the day. The quantity of gas which passes in and out of these holders in the course of a year is so great that the capital charges which the provision of such holder accommodation lays on each 1000 cubic feet of gas are small, whereas they would become enormous if it were a question of prolonged storage of the gas. Mr. Watts evidently does not realize that gas is the most awkward of bye-products to store and utilize, and that the working of ovens the primary purpose of which is the regular output of coke cannot be readily adapted to meet the demands of a town community for gas, which demands fluctuate not merely from morning to evening but from week to week, and season to season. The capital charges on the gas produced in that portion of the carbonizing plant, with its accessory condensing, scrubbing, and other apparatus, which is constantly working at its maximum output, are so low on a gas-works that the holder cost of this portion of the gas would in most instances be lower than the cost at which gas could be delivered at the works from coke-ovens in the neighbourhood. It is the additional plant required to meet the increased output in the darker and colder weeks of the year that raises the average holder cost of gas to a figure which makes the proposition of a coke-open supply appear plausible. But the additional plant, carrying a heavy burden of capital charges, cannot be dispensed with, unless the coke-ovens can always supply more than the maximum requirements of the gas undertaking, in which case there will be an enormous surplus of coke-oven gas at other times. Mr. Watts presumably would store this surplus, since he assured his Cardiff audience that gas could be stored for any length of time! It is hoped that before he advances further proposals for the utilization of coke-oven gas for town supplies, he will study the conditions in which the gas industry works, and will bear in mind that the price at which coke-oven gas can be delivered to a gas-works must be compared with the holder cost of gas manufactured on the same works, and not with the price which the consumers pay for gas when delivered to their houses.

The third address at the Cardiff Conference was by Mr. R. H. Greaves, M.Sc., of the University College and Technical School, Cardiff, who dealt with the "Coal Trade and Allied Industries." He is to be congratulated on having brought together in his address a large collection of useful and up-to-date statistics on exports and imports of coal, coke, patent fuel, and bye-products of the gas and coke industries, chiefly in regard to Germany and the United Kingdom. He appears, however, to have regarded the export of Welsh coal to foreign markets as a movement to be encouraged, whereas many national economists think that severe restrictions should be placed on the dissipation, for the advantage of other lands, of the chief of our industrial resources.

Mr. Greaves was followed by Mr. W. J. A. Butterfield, M.A., of London, whose address [reprinted in to-day's "JOURNAL"] dealt with the "Products of Coal Distillation." The points in the address, which may strike many readers as novel, were suggestions: (1) That works which are now extracting toluol from their gas should continue when the war is over to extract about one-third of the benzol—since the residual gas is stated to be above the now accepted calorific standard of 500 B.Th.U. per cubic foot, and benzol is in increasing demand as a motor spirit; (2) that coke-breeze should be briquetted [on this matter a translation of a paper by the Manager of the gas-works of Kolberg on the Baltic coast appears in to-day's "JOURNAL," p. 212]; (3) that research should be vigorously pursued on methods for the oxidation of the sulphur in gas and its direct combination with the ammonia; (4) that cyanogen recovery should be extended in this country; and (5) that women should qualify themselves to act as research assistants in coal-tar colour works, should such works become established on a large scale in the United Kingdom.

The second day's proceedings at the Cardiff Conference comprised the reading and discussion of two papers; neither being of direct interest to gas men. One was by Mr. E. Russell-Taylor, J.P., on the "Beet Industry," and the other was by Lieut.-Col. C. S. Denniss, of the Cardiff Railway Company, on "Cardiff as an Importing, Exporting, and Distributing Centre." The Conference was well attended by business and other men of influence in the locality; and while immediate results in the direction of the extension of British trade can hardly be anticipated from it, there is no doubt that some of the suggestions made in the addresses and the discussions which ensued thereon will ultimately prove fruitful. It was noticed that Mr. George Clarry, the General Manager and Secretary of the Cardiff Gas Light and Coke Company, was an attentive, though silent, witness of the proceedings.

WAR PRECAUTIONS AT SOUTH SHIELDS.

Gas Supply during Threatened Bombardment and Air Raids.

IN a statement on the subject which he has prepared, Mr. T. H. Duxbury, the Engineer and Manager of the South Shields Gas Company, says that since the commencement of the European war, there had, up to Friday last, been four distinct occasions when the Company has received urgent orders from the military to turn off the gas supply to the town, and on three the pressures at the outlets of the station-governors have been reduced to about 5-10ths, as lately arranged with the military authorities, instead of absolutely cutting off the supply. No troubles have resulted in the district or on any consumer's premises, so far as is known. This freedom from mishaps is, in his opinion, due to two main factors: (1) Not reducing the gas pressure at the outlet of the station-governors below 5-10ths; and (2) precautions that were taken prior to, and since, the first actual "turning off," to warn consumers by advertisement, &c.

On the day of the West Hartlepool bombardment, the military sent an order to immediately turn off the gas at the South Shields Company's two works; but, as a matter of fact, before the gas supply had been turned off an order came through that it might be turned on again. This happened during the forenoon of Dec. 16; and the same day the Company inserted in the local Press a warning to all their consumers of the possibility of the supply being turned off at any time, and briefly advising them what to do.

On Jan. 1, the Company received orders from the Commander of the Tyne Defences that they must be ready at a moment's notice to turn off the gas supply at any time on receiving instructions from the military; and on the 24th of the month, the Commanding Officer, as a precautionary measure, inserted in the local Press a warning to all consumers of the possibility of both gas and electric light being turned off, and advising them to have candles or lamps available, as the gas supply would not be turned on again until the morning following any such turning off. Meanwhile, the subject was discussed at a meeting of the North of England Special Purposes Section; and it was decided to communicate with the Commanding Officer of the Tyne Defences and ask him to receive a deputation for the purpose of discussing reducing pressures instead of absolute turning off. The matter was discussed, and subsequently the Commanding Officer wrote agreeing that in future when the order was given to turn off the gas supply this should be deemed to mean reduce pressure to 5-10ths at the station-governors at the gas-works. The Company have

acted accordingly ever since then, getting the pressure as near to 5-10ths as possible. It has since been arranged that the Chief Constables of the Tyne district will in all cases issue the order to the gas undertakings to reduce pressure.

These arrangements were made prior to the first occasion when the Company had to actually turn off the supply—that is, reduce the pressure. This first occasion was on Wednesday, the 14th inst., about 8.20 p.m., when a Zeppelin arrived over Blyth, travelled to Wallsend and back over South Shields, dropping bombs on various places, but fortunately not on any gas-works, though it passed over the South Shields works. At midnight the order came through from the military that, as the danger was then over, the electric light was to be turned on at once; but the gas supplies must not be turned on before 10 o'clock next morning. This order was carried out, to the serious inconvenience of householders at breakfast-time, and to works which had gas-engines, &c. Mr. Duxbury put another advertisement in the local paper the day that the gas was being turned on. This was not simply applicable to that particular occasion, but as a "reminder" to gas consumers for the future; and it was as follows: "The gas supply having been turned off by orders of the military authorities last night, consumers should see that every gas-tap to burners and gas-fires and cookers has been turned off. Unless otherwise ordered by the military authorities, the gas supply will be turned on at 10 o'clock this (Thursday) morning, April 15."

The next time airships visited the district was three days later —Saturday, April 17—when the order to turn off gas was received just after midnight, and the pressures were at once reduced by the foreman at both the Shields and Jarrow works, while lamplighters and special constables began extinguishing gas-lamps. No damage was done by the airships on this occasion. At 3.30 on Sunday morning the order came through that the danger was then over, and electric light was being turned on at once; but the gas supply must not be turned on until 10 o'clock Sunday morning. This was, however, afterwards altered to 6 a.m.

The last occasion the Company were ordered to turn off was Monday night last week, when the order came through about midnight; and the same procedure was followed as on the preceding occasion—the electric light being turned on about 4.30 a.m., and gas at 6 a.m.

The Company have two works, situate about four miles apart; and they are connected by an 18-inch pressure main, arranged so that the exhausters at either works can send gas as made into the holders at the other works. At the Shields works there are inclined retorts and carburetted water-gas plant; while at Jarrow a Woodall-Duckham vertical retort installation is the sole gas-producing plant.

On the occasion of the first air-raid, Mr. Duxbury stopped gas making at both works by not charging any more retorts at Shields, and, with the vertical installation, stopping the extractors, and eventually stopping the exhausters and opening the relief valves. On the second and third occasions, he continued gas making at Shields right through the night, but stopped gas making at Jarrow. On all the occasions immediately the order came through that the electric light was being turned on, Mr. Duxbury opened-out the pressure main connecting the two works and started gas making at both works (long before turning-on time), but meanwhile had closed the valves of the district governors, which valves were not opened until turning-on time, 6 a.m.

As gas-works are a goal for the enemy, Mr. Duxbury has practically all outside lights in the works entirely out of lighting, and has reduced to a minimum inside lighting in the various buildings. Practically all these lights are extinguished immediately after the gas supply to the town has been "reduced." Members of the staff have assembled at the Shields and Jarrow works on all occasions, and also the Distribution Department emergency men, in case of any district troubles.

Dr. Rittman's Benzol and Toluol Processes.

The "American Gas Institute News" for the current month contains the following remarks on the processes discovered by Dr. Walter F. Rittman, the Chemical Engineer of the United States Bureau of Mines, for the production of benzol and toluol, to which reference has already been made in the "JOUUNAL:" "Briefly, Dr. Rittman's discoveries are that by the application of the laws of physical chemistry it is possible greatly to increase the yield of gasoline obtained from crude oil, and also to produce benzol and toluol, which are essential in the manufacture of dyes and explosives. It is too early to predict what will be the effect on the welfare of our country. An increased production of gasoline, resulting in a cheap product, will undoubtedly cause an increase in the use of power from internal-combustion engines. An increased yield of benzol and toluol will perhaps stimulate our dye manufacture; but, as this industry is dependent on other conditions besides the price of raw materials, it is hard to say what will be the result. It will also greatly depend on the duration of the European war and the state of the warring countries, and particularly Germany, after the war. Dr. Rittman's process has not so far been tried on a manufacturing scale, so no cost comparisons with the products from coke-ovens are available. What particularly concerns us is the effect on the supply of gas oil. It is evident that, with more of the crude oil being made into products other than gas oil, the production of the latter will be affected. How much, we cannot say at this moment."

MODERN ILLUMINANTS AND ILLUMINATING ENGINEERING.

Review of Messrs. Gaster and Dow's Book.

(*Concluded from p.* 133.)

IN Chapter VI., a good presentment is made of the different theories which attempt to explain the faculty of vision and the perception of colour. The subject is a many-phased one, and it is impossible to adequately indicate in a short paragraph or two the contents of this chapter of some forty pages.

The difficulties provided by what was once described as an imperfect optical instrument—viz., the human eye, with its light sense and colour sense apparently operating separately, the varying effects both of high and low illumination and of the several colours of the spectrum, the physical and luminous differences of light sources, the phenomena of reflection and the like—all tend to furnish complex problems for the student. He has, as the authors suggest, to study closely the processes involved in the production of light, and then the effect of the light produced on the eye so far as perception of form and colour is concerned.

The ideal source of light should (1) develop all its energy in a visible form with (2) such a distribution throughout the spectrum that the light should be approximately of a "white" character. Following this statement, the authors reproduce Langley's graph showing the distribution of energy respectively in the spectrum of the sun, arc, and flame, and also a table of the luminous efficiencies of various illuminants. These show clearly how small is the percentage of the total energy of the respective illuminants which is radiated as visible light, and further seem to indicate the possibilities of enormously greater efficiencies, if the energy spent in invisible radiation could be converted into light. This appears to be already taking place in the case of illuminants of increasingly high temperatures; and as efficiency has thus improved the light has become apparently whiter in tint. The authors point out that another possible means of improving efficiency is by the choice of materials which depart widely from the blackbody law and exhibit "selective radiation." The Nernst filament, the incandescent mantle, and the metallic filament lamp, all seem to exhibit this quality to some degree.

The diagram showing the distribution of luminosity in the solar spectrum at high and low illuminations amply bears out the statement that while at the former the eye takes full advantage of the more efficient rays near 0·58 μ, it is more sensitive at weak illuminations to the blue-green end of the spectrum. Tests of minimum—that is, of the lowest—illumination in streets would thus appear to favour the light sources in which the latter colours preponderate, to the disadvantage in appraisement of the more important colour rays. The authors themselves say that "fairly high illumination should be judged on what may be called the upper register of vision."

There is interesting food for thought in the section of this chapter devoted to the colour of illuminants. Although endeavours have been made to produce artificial imitations of daylight, one agrees with the writers that it is questionable whether, except for special purposes, people desire an exact duplicate. Possibly a change to the warm tones of most artificial illuminants is an advantage. The tables of both Nichols and Voege, showing the relative proportion of the colour constituents of the chief illuminants, are given, and are well worthy of study.

The remaining pages are usefully devoted to the practical application of coloured light, and the reflective effect of coloured surroundings. Ritchie's table, showing the change in the appearance of coloured objects under different lights, is interesting. In another edition, Mr. J. G. Clark's recent data of the effect of gas and probably other forms of artificial lighting, as compared with daylight, on coloured materials will probably be included, adding usefully to the information given. These two chapters on illumination and colour in relation to the eye are very well done; and the information collected and commented on by the authors will be found serviceable and suggestive.

For the chapter on the measurement of light and illumination, Mr. Trotter's book on the subject has evidently been a very useful mine; and the authors cannot be blamed, because of the excellence and lucidity of that gentleman's work in this direction. The difficulty has, however, undoubtedly been to compress within the limits of a chapter all that is essential to the general student; and this attempt has at times been none too successful from the point of view of clarity.

In the appraisement of the comparative value of illuminants, two implements, as the authors say, are necessary—viz., a standard of constant intensity and a photometer. Description of the several standards now used in England and abroad is disposed of in less than a page. Perhaps there is no great need for any lengthy treatment; but since the expression "candle power" is still universal and important modern standards have been based on the British candle, the remark that the latter had to be of "a certain weight and to burn so many grains of sperm per hour," should have been slightly amplified, rather than dismissed as an indifferent standard, if only for the sake of historical record. This is of some importance, since the petane 10-candle unit was, as Mr. Trotter said, "standardized by many comparisons with the British parliamentary candle used in the authorized method" and the relation-

ship of this standard to the Hefner unit and Carcel candle established—the ratios themselves being given by the authors.

The reference to the use of "carefully aged electric incandescent lamps" as a means of checking the constancy of flame standards, and the authors' subsequent remarks on electrical secondary standards, are not altogether clear. The student may be left with some idea that the pentane standard had lost its position.

The lack of clearness appears again in the pages devoted to derived units, as for instance, in the table given on p. 212, where "International" lux and Hefner lux are both followed in parentheses by "metre candle," as if the same "candle" standard were implied. Surely, in the second case it would have been safer to say "metre Hefner."

On page 217, a table of the chief quantities used in illuminating engineering is given. The desire to be brief has achieved something like a jumble here. Under the heading "Quantity" we have "Intensity (Lichtstärke, Intensité lumineuse)," the units of which are given as "International candle (Hefner kerze)." Is not the student likely to infer that the "Hefner kerze" is interchangeable with "international candle"? The same absence of clear distinction between the international candle and the Hefner unit obtains throughout the table.

In dealing with M.S.C.P., the authors point out that the intensity of light sources varies considerably in different directions, and rather suggest that they can only be compared by taking into account the light on this basis. In a sense this is so, if one is to think of total flux; but who, for practical every-day purposes, would buy a lamp by its M.S.C.P. rating? The book does not deal, except in the case of arc lamps, with comparison on the mean L.H.S. candle-power basis, or in any other way with the rating of light sources, which makes the suggestion of M.S.C.P. tests the more misleading. These pages, following the excellent pages on colour, are to some extent disappointing.

Leaving the discussion of the standard of light, we come to that of the appliances used for the measurement of intensity, and here again brevity in a few cases has been unfortunate. One wonders what conception of the ordinary photometer is likely to be formed by the general student from a perusal of the descriptions on page 218. The description might well have been helped by illustrations. It is noted that the word photometer is here applied to the screen itself, although previously, and in connection with illumination photometers, the word covers the appliance as a whole. So far as the usage of the instrument is concerned, the authors only refer to the method of "double weighing" as being used for standard work, somewhat ignoring the direct comparison which has been so long in practical use.

Following the discussion of colour photometry, we come to another phase of the subject—that of the study of the distribution of light from illuminants, and the method of measuring it. The increasing attention now given to the light actually received quite naturally called for, and obtains, arguments in favour, and adequate descriptions, of the several types of illumination photometers now on the market. None of these are regarded as perfect; but improvements are being made such as to make the method practical and convenient. For the appraisement of indoor illumination these instruments are exceedingly handy, since they take into computation all contributions in the way of light. The claim that results can be obtained within 10 to 15 per cent. is not great, although it is stated that experienced and skilled observers work to considerably greater accuracy by taking special precautions, which undoubtedly is, and should be, the case. A reference is made to the application of these instruments to outside work; and the chief arguments for and against the appraisement of street lighting by minimum illumination data are stated. The authors admit the measurement of street illumination to be much more difficult than that of indoor lighting, and that the comparative advantages of measuring candle power and illumination are still debatable. The whole chapter with the numerous references is informative and will prove useful.

Much the same can be said of the following section, which deals with globes, shades, reflectors, and calculations necessary to secure defined illumination results. The modifications of the polar distribution of light from various illuminants which can be procured by the use of globes and reflectors, are such that no lighting practitioner can afford to give the subject other than close attention. The functions of such agents were summarized by Messrs. J. G. Clark and V. H. Mackinney as (1) the toning-down of excessive brilliancy, (2) the direction of light where needed, (3) softening of shadows, and (4) service as decorative objects.

The authors had in the fifth chapter been inclined to the view that 2 to 3 candle power per square inch was permissible. Here, however, they raise the figure to 5 candle power; but in any case they properly insist upon the desirability of bearing in mind the motto "light on the object, not on the eye." Types of shades and globes are described and illustrated; special attention being paid to those of the Holophane kind. The polar diagram of light sources showing the effect of the use of prismatic glass in this way are self-explanatory as to the excellence of light redistribution. The relatively small amount of light absorbed by glass of this character compares very favourably with that by ordinary patterns of globes, the absorptive effect of which may vary from 10 to 50 per cent.

Several pages follow as to the spacing of lighting units with reference to the globes and reflectors with which they are fitted; and for much of the information given the "Holophane" literature is again laid under contribution. Practically all the illustrations are of electric lamps, although equally good examples of gas illuminants could have been taken from the same Company's series of pamphlets.

The authors have apparently great faith in the indirect and semi-indirect illumination methods, although they fully realize that loss of light is unavoidable. In the former system, the consumption is usually about twice that required with the direct method. They also do not ignore the facts that the efficiency drops as walls and ceilings darken, and that there are other features which are not quite satisfactory. The semi-indirect system makes a greater bid for popularity, because it in part combines the advantages of both direct and indirect lighting, and does not involve so great a loss in efficiency. This method, it is suggested, is more favourably regarded by the gas industry. The use of gas for indirect lighting is, however, referred to more or less incidentally. Sugg's semi-indirect gas lighting unit is shortly described; but, in spite of the excellent examples in use and shown at the recent National Gas Exhibition, one would be almost inclined to think from this chapter that gas was out of the running. The Holophane catalogues themselves show that this is not the case.

Chapter IX. is interesting and useful, since it deals with problems of interior illumination covering such subjects as the consumption of gas and electricity to produce a given illumination—expressed "per lumen on the working plane"—with direct, indirect, and semi-indirect systems, the intensity of illumination required for various purposes with a table taken from the Holophane catalogue, and general recommendations and suggestions as to the lighting of dwelling houses, shops, offices, halls, hospitals, churches, galleries, workshops, and other places. Most of the information has appeared within the last year or two in the pages of the "Illuminating Engineer," but is well worth reproducing in this handy form. Gas lighting in some cases is ignored; electric fittings being apparently in mind. Indeed, the possibility of using gas appears here and there almost as an afterthought. In the domestic lighting section, for instance, suggestions are made of conversion of old chandeliers to electric fittings, of electric light plugs and portable lamps for dining room local illumination, of preference by some servants for oil over electric lamps in kitchens, &c., in such cases as if incandescent gas-burners did not exist.

The authors make reference to the many trades—such as printing, engraving, and the textile industries—where considerable demand is made on the eye and the necessity of adequate illumination becomes obvious. They quote the useful points of recent reports by H.M. Chief Inspector of Factories; but while dealing generally with the subject, both as to gas and electric lighting, the character of the illustrations of different systems are not altogether favourable to the former. One has only to refer to the comparison of good and bad methods of lighting compositors' frames. The defective illumination is entirely due to inefficient shading. Yet the bad example is that of incandescent gas-burners, and the good of electric glow lamps, notwithstanding the fact that the source from which the illustrations were obtained actually afforded an excellent example of shading in connection with gaslighting. The present writer, too, could give actual examples of the exact converse where in a printing establishment high-pressure gas has displaced electricity upon the score of the eyesight of the compositors as well as of the very important factor of economy. It is a pity that a little more has not been said about the use of high-pressure gas, especially as there is now available a good deal of information on this phase of lighting. A short reference is made to the use of sunburner incandescent gas units, although none is offered as to the additional value of these as ventilating agents. One does not, however, depreciate the general value of the chapter; and the reader may be assured that he will find ample to repay his study of this section.

The last chapter is devoted to outdoor and street lighting. This subject, like perhaps some of the others, requires a volume for adequate treatment. So far as street lighting is concerned, the authors record what is undoubtedly the satisfactory fact that, while keen competition between two illuminants has given rise to much partisan discussion, the meeting of the two interests around the common table of the Joint Street-Lighting Specification Committee is conducive to good illumination results. The suggested minimum horizontal illumination values for certain classes of streets is given, but no information as to the nature of the classification of the streets. Illustrations of streets lighted both by high-pressure gas and by electricity (arc and filament lamps) are here included.

Generally the authors are to be congratulated upon the production of a readable book, and students possessed of ordinary technical knowledge will find the vast amount of information thus collected, together with various comments and the numerous references for those who wish to specialize, of a very serviceable character. The book has been perused with some pleasure.

Welsbach's Works for the Gas Industry.—At the last annual meeting of the Newcastle Economic Society, Professor P. P. Bedson, of Armstrong College, read a paper on "The Economic Importance of Scientific Research." In the course of it he showed how the researches of Baron Auer von Welsbach had given a new life to the coal-gas industry, helping it to maintain its position in face of the growing development and application of electricity as an illuminating agent.

RATEPAYERS AND ELECTRICITY CHARGES.

A Question of Principle Illustrated by Faversham.

ELECTRICITY companies and municipal authorities owning electric supply undertakings are, in London and elsewhere, raising the prices of current owing to the, under war conditions, increased costs of production and of carrying on their concerns. This is quite the correct thing to do, and especially in the case of local authorities possessing electricity undertakings—subject to the qualifications that the price is not put up for the mere purpose of producing money to go in relief of the rates, and so cause unequal taxation, and that it is not raised if there is a good reserve fund upon which to fall back. But a question of principle comes in, even (it might be said) one of morality, in the case of a local authority electricity concern that has never paid its way, and has had an existence tantamount to that of a pauper—in other words, has always been dependent upon the rates. Perhaps if we searched the country through, we should not find a better example of this class of undertaking than the one at Faversham; and really, when one considers its history, every reason is found why Parliament should put a limit to the period during which such a concern should be allowed to draw upon the rates, and supply people with current at prices which do not bring in sufficient revenue to render the undertaking self-supporting. Year after year the concern has been maintained out of the rates; and now, when the ratepayers generally are heavily burdened through the war, and have out of their own pockets to meet these burdens, the Electricity Committee have decided not to raise the price of electricity (despite the fact that the Chairman of the Committee himself proposed that it should be advanced), which is equivalent to saying that the users of current, who have already cost the general body of ratepayers so much, shall be relieved of the additional costs falling upon the undertaking by placing them on the already long-suffering and far too patient ratepayers.

The management of the electricity undertaking by the Council (the members would not manage their own trading in this way) has been of such an unbusinesslike order that, up to March 31, 1914, it has been a charge upon the ratepayers to the extent of no less than £10,624. This is the sum the ratepayers have contributed towards supplying the consumers of electricity with the current they require. The electricity consumers, on the other hand, do not contribute anything towards the supply of the consumers of gas. On the contrary, the consumers of gas—directly from their own pockets, indirectly through the Gas Company—have to support the electricity undertaking. Now that there are additional costs falling upon the electricity concern (as there are upon the Gas Company, and more serious ones upon the latter than the former), they are simply to be piled upon the already heavy accumulation of deficiency made by the undertaking, and liquidated by the ratepayers. This taxing—this "robbery" would be a more appropriate word—of the whole body of ratepayers to save the pockets of the comparatively few electricity consumers, is an indefensible proceeding, and will be accounted more so when we come to look into the position a little more closely. In 1913, the amount of the deficiency which fell upon the rates was £1030; and in 1914, it was £1064, or £34 more; and yet—mark this!—the undertaking in the latter year sold 86,639 more units. This was before the war—before the war was thought of in Faversham or elsewhere. If a large increase of business means an increased draft on the pockets of the ratepayers, then the sooner the concern is handed over to the administration of a more competent body, the better for the ratepayers. When in the twelve months ending March, 1913, 120,418 units were disposed of for private and public purposes, and £2038 1s. 5d. was received for these units, this represented an average receipt of 4·06d. per unit. When in the year ending March, 1914, 207,057 units were sold, and the income for current was £2599 1s. 2d., this was an average per unit of 3·01d.—that is to say, the average received per unit was 1·05d. less in 1914 than in 1913, although so much extra business was done. It is evident from this that the new business was accepted at a relatively low average price; otherwise it should have produced something in the way of profit to reduce the amount extracted from the pockets of the ratepayers. It is the height of folly to do business at a loss. What is found in this case? First, that practically the whole of the extra consumption was obtained from private sources; secondly, that the difference in the income from current (private and public consumption) between 1913 and 1914 was only £560 19s. 9d.; and, thirdly, that this sum, divided by the increased sale (86,639 units), is equivalent to an average receipt per unit for the extra sale of about 1·55d. But the revenue account says: "By sale of current per meter at 6d. per unit, and for power at 3d., 2½d., and 2d. per unit." These figures and the 1·55d. suggest that there is some discrepancy between printed statement and fact. Supposing the average receipt per unit had been the same in 1914 as in 1913—that is 4·06d.—and the quantity of current sold was that of 1914, this would have meant an additional revenue of £903 odd, which would have gone a long way towards eliminating the £1064 deficiency. We do not say that the whole of the extra quantity sold would have been at the higher price; but the plain facts stare one in the face that, though 86,639 units more were sold in the year ending March, 1914, the balance of gross profit carried to the net revenue account was only £417, against £460 the previous year, and the deficiency was, as already mentioned, £1064, as against £1030. So that the extra business did no good in the financial result.

These figures relate to the financial year preceding the war. Worse times have come. Fuel is costing more; and the "cost of living" for all undertakings, as well as for individuals, is now greater than before. Despite the figures we have quoted for pre-war times, despite the additional financial costs and obligations, despite the annual recourse to the pockets of the ratepayers for support of this ill-starred concern, the Electricity Committee have, as previously said, determined to make the general body of ratepayers meet any larger deficiency that may be incurred rather than cause electricity consumers to bear the extra costs of supplying them with the electrical energy they need. Emphatically it may be said there is no equity in this. But this is electrical administration at Faversham. The electricity consumers (how many members of the Electricity Committee are consumers?) ought really to be ashamed of themselves for continuing year after year to be the recipients of pecuniary aid forced from the ratepayers generally. The Gas Company have raised the price of gas by 5d. per 1000 cubic feet to meet their increased costs; and probably one of the motives which prevailed in deciding against an increase in the price of electricity is that the Committee may try to attract additional business by pointing to the fact that electricity has not been raised in price while gas has. The ratepayers will see through this trick. The extra costs falling upon the electricity concern have to come from somewhere. The Council have only two sources of income in this connection—the electricity consumers and the ratepayers. The ratepayers as a body are the ones who have to pay; and the ratepayers should strongly protest not only against a form of administration which produces annual losses, but against a form of administration which confers a pecuniary advantage on an electricity consumer by placing a pecuniary disadvantage upon the non-electricity-consumer. It is high time there was an end put to this plundering of the ratepayers on behalf of the electricity consumers; and now that there is an additional loss threatening through increasing costs, the ratepayers should make a serious move against the injustice.

SIXTY YEARS AGO.

From the "Journal" of April, 1855.

Register of New Patents.—No. 2005. George Frederick Evans, of Hanover Lodge, Kew Bridge, in the county of Middlesex, gas engineer, and Frederick John Evans, of the Gas-Works, Horseferry Road, in the same county, for "Improved Apparatus to be Used in the Distillation of Coal, and Other Bituminous or Resinous Substances." Patent dated Sept. 14, 1854. This invention of improved apparatus to be used in the distillation of coal and other bituminous or resinous substances, relates more particularly to the retorts or vessels in which the distilling process is carried on for the purpose of obtaining gas for illumination, but is also applicable to retorts for distilling bituminous or resinous substances for other purposes. Hitherto coal and other bituminous or resinous matters from which gas for illumination is usually obtained have been submitted to the distilling process either in cast-iron retorts, which are liable to injury from the great heat to which they are usually subjected during the process of distillation, or in earthen retorts, which are to a certain extent porous, and will consequently allow the gas to escape; or their inner surface, being rough or porous, will allow the carbon to condense thereon, and in time choke up the retort, and cause other inconveniences. Earthen retorts do, however, possess certain advantages over iron retorts, and have therefore been very generally used for some purposes in place of the iron ones. The principal object of the present invention is to obviate and remedy the objections to which these earthen retorts are open; and this is effected by coating the retorts internally with an enamel or glaze, which will prevent the gas from escaping through the pores of the material of which the retort is composed, and will also, by presenting a smooth surface, prevent the carbon from adhering thereto, and forming a crust thereon. Any of the processes which are well known and in use, or that may hereafter be invented for glazing or enamelling surfaces, may be employed for the purpose of this invention.

Economical Advertising.—An advertisement inserted in the "Journal of Gas Lighting" will, in nine cases out of ten, be repeated gratuitously in the "Gas and Water Times."

Iron and Steel Institute.—It was recently mentioned in the "JOURNAL" that at a joint meeting of the Staffordshire Iron and Steel Institute, the Birmingham Metallurgical Society, the University Metallurgical Society, and the Birmingham Section of the Institute of Metals, held in the University of Birmingham, Professor H. Hubert, of the Ecole des Mines, Liége, delivered an interesting lecture on "The Evolution and Recent Progress in the Design of Large Gas-Engines, more especially dealing with Large Continental Blast-Furnace Gas-Engines." Professor Hubert will deal again with the subject at the annual meeting of the Iron and Steel Institute, which will be held at the Institution of Civil Engineers on the 13th and 14th prox. It is expected that M. Greiner will on the same occasion submit a paper on "The Heating of an Open-Hearth Furnace by Means of Tar."

DEHYDRATION OF WATER-GAS TAR AT THE AMSTERDAM WESTERN GAS-WORKS.

WE have received from an esteemed correspondent in Holland the following account of what has been done at the Amsterdam Western Gas-Works in the direction of the dehydration of water-gas tar, and the results obtained. He prefaces his particulars with the remark that, judging from the literature of the subject, the treatment of tar causes trouble in many gas-works. But he points out that experience shows that troublesome things may be remedied by persistent effort; and he shows this by his communication.

For the production of carburetted water gas there are at the Amsterdam Western Gas-Works four sets on the Humphreys and Glasgow system, each of 525,000 cubic feet daily capacity. For carburetting, a common kind of American gas oil is chiefly used. After the installation of the plant, the temperatures in the carburettors and superheaters were regulated at first according to the colour of the bricks, as seen through the sight-holes; but afterwards pyrometers, with recording galvanometers, were permanently fixed in the superheaters. These instruments effected a considerable improvement in the composition of the tar. The operatives highly appreciated them, for by their use the working of the plant and the maintenance of the right temperature were made a great deal easier. Owing to the regular temperature, the tar has become somewhat denser, floating tar has totally disappeared, and the quantity of the emulsion has decreased considerably. A fact of great importance was that the quantity of oil necessary for keeping up a fixed calorific power in the gas could be decreased; so that the first cost of the recording instruments was to a large extent repaid by greater economy.

From the outset there was presented the question of the extraction of the water from the tar. For dehydrating the coal-gas tar there was on the works plant consisting of four centrifugal machines of Burmeister and Wain's (Copenhagen) make. This plant, which was in regular work, had always yielded the most satisfactory results, as the rather thick coal tar was dehydrated in one operation from 25 to 30 down to 2 to 3 per cent. water content. The plant is capable of dealing with 20 metric tons of coal tar in a nine-hours working day.

As this plant worked for about nine or ten years with the best practical and financial results, the same method was tried with the water-gas tar. According to theory, the difficulties would be many times greater, owing to the very small difference in specific gravity between water and water-gas tar. With coal tar and water the specific gravities are 1·25 and 1, while with water-gas tar and water they are 1·05 and 1; and as the centrifugal separation of the tar and water is mostly due to the difference in the specific gravities, the difficulty of the process can be easily understood. It therefore goes without saying that the first experiments were altogether unsuccessful. Upon one occasion, however, a sample was obtained of water content of less than 1 per cent. As this showed the possibility of effecting the centrifugal dehydration of the water-gas tar, it became important to throw some light on the circumstances governing the separation of the tar and water. For this purpose numbers of investigations have been made, with the gratifying result that the whole matter became perfectly clear. When immediately afterwards the theoretical speculations were applied in practice, the results proved that the whole affair rested on a sound basis.

The entire question of the successful dehydration of water-gas tar turns upon the point that this tar and water have not only different specific gravities, but that at different temperatures the curves representing them do not run parallel, but diverge considerably. The fact is, therefore, that the higher the temperature of the tar the wider is the difference between the specific gravities of the two liquids. An account of the greater part of these investigations has already been given in the "JOURNAL."* The misfortunes of those who have tried to dehydrate water-gas tar in centrifugal machines are possibly due to the circumstance that they have operated at the fairly constant temperature of about 50° C., which is generally employed in dealing with coal tar, and also have not taken account of the lower specific gravity of the water-gas tar.

As may be known to "JOURNAL" readers, the centrifugal apparatus has a drum revolving at high speed on a vertical shaft. This drum has, at the upper parts of the interior, a flat ring, 4 inches wide, fitted in such a way that a small free space is left between the inner surface of the drum and the outer circumference of the ring. When by the high-speed revolution the tar and water are separated, the tar travels upwards along the inner surface of the drum, through the free space, to the upper side of the ring, where it makes its exit through the tar offtake. The water, being lighter than the tar, forms a layer at the side of the tar, and, travelling upwards, its passage is barred by the flat ring, so that it is forced to creep along the under side of the ring, where there is a similar outlet for the water.

Practice has demonstrated that the column of tar above the ring is in a kind of equilibrium, and in this equilibrium the specific gravity is, of course, of importance, causing the formation of a thinner and higher or of a thicker and lower column. In connection with this circumstance, the tar offtake should be placed nearer to or farther from the inner surface of the drum—this being a question of tenths of inches. The whole matter is one of trial; but for a workman who understands his job in the treatment of coal tar, the necessary experience is acquired in a day. Care should be taken that the inflow of the watery tar is not too fast, for a plant adequate to treating 20 tons of coal tar per shift is only capable of dealing with about one-third of this quantity of water-gas tar.

Furthermore, the whole operation is a question of suitable temperature. The pre-heating of the tar is done in tanks which are closed, though sufficiently accessible for inspection. In Amsterdam there is an ordinary rectangular tank with a cover of sheet-iron, in which a couple of doors have been made. On the cover there is a tube going upwards through the roof of the building. This is necessary, for the crude tar sometimes retains certain gaseous parts in solution, which escape when the tar is heated, and then the possibility might arise of an explosive mixture being formed. Now all these gases can escape through the outlet-pipe into the open air. On an average, the temperature necessary for the perfect dehydration of the tar lies between 60° and 70° C. For the pre-heating, live steam or waste steam may be used. The heated tar has very often a water content of about 60 per cent.; but this does not matter, as one operation in the centrifugal machine is sufficient for the delivery of almost water-freed tar—*i.e.*, tar with less than 1 per cent. of water.

When the crude water-gas tar contains more than 60 per cent. of water, the appearance of the mixture is sometimes not different from that of ordinary tar, only that it is very often more viscous, in which case there is formed a sort of emulsion, eventually mixed with what may be called sludge. Real water-gas tar emulsion contains about 80 per cent. of water, and samples have even been tested where the amount had risen to 90 per cent. without any difference in appearance being shown. These emulsions are treated in the same apparatus and in a similar manner; only in this case it is necessary to raise the working temperature still further—even up to 95° or 100° C. There is no danger in this, as no fractions evaporate at this point. The whole dehydrating operation gives no trouble either to the workmen or to the works chemist—in fact, it is more easy than it appears to be from the somewhat detailed description of it.

The tar treated in the centrifugal plant has a very low content of so-called free carbon; the quantity varying between zero and 4 per cent. This causes a very low figure for the quantity of ash; the latter remaining far below 0·5 per cent. The specific gravity of the finished product is about 1·05, and its calorific power, on an average, 17,200 B.Th.U. per pound. The commercial value of the water-gas tar is considerably raised by the centrifugal treatment. The water is eliminated, as are also all floating particles, soot, dust, and free carbon; and a product entirely uniform in character is obtained. For owners and managers of gas-works, an important fact is that no extensive storage plant for crude tar is required, as is the case when this product has to separate by gravity alone. The tar produced in the morning may be treated in the afternoon and delivered for sale next day. As the emulsion totally disappears, and is entirely broken up into water and marketable tar, there are no waste products. The residue left in the centrifugal drums is mixed with coal and carbonized, resulting in very clean ascension-pipes.

The working costs of the treatment are particularly low. In commerce the centrifugally treated water-gas tar is most highly appreciated by the different classes of consumers. Owing to its constant character, it is being very generally substituted for mineral oil as fuel. Numbers of internal combustion engines have already been running a long time on this tar, and are giving much satisfaction. The working costs are a great deal lower than with crude oil or gas oil; and the effects on the engines are the same. This tar is also very much in use for fuel purposes. In the first place, the metal industry employs it for melting crucible steel, iron, nickel, copper, brass, &c. In gas-works, all the melting of metals for the foundry is done with water-gas tar; and the relative consumption per pound of molten metal is very low. It is frequently used for heating bakers' ovens, specially those in which gas oil had been the heating agent.

As may be gathered from what has been stated, the centrifugal treatment of water-gas tar for its dehydration is a very recommendable operation, giving a product of uniform quality, almost free from water, and containing practically no free carbon—in short, a product commanding a favourable market, with better prices than those obtainable for tar not centrifugally treated.

* See the articles on "The Centrifugal Treatment of Water-Gas Tar," in Vol. CXVII., pp. 359, 656.

Supply of Sulphuric Acid for Government Contractors.

In view of the importance of sulphuric acid in the manufacture of materials required for Government purposes, an Advisory Committee has been appointed in connection with the "High Explosives Department" of the War Office to assist in ensuring an adequate supply of acid to Government contractors. All communications on the subject should be addressed to the Secretary, War Office High Explosives Department (A.6), Storey's Gate, Westminster, S.W.

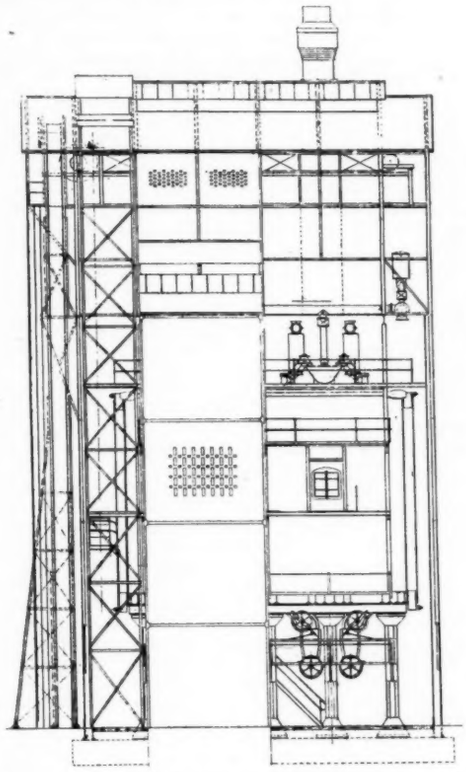
VERTICAL RETORTS AT CANNOCK.

Opening of a Woodall-Duckham Installation.

A new chapter in the history of the undertaking of the Cannock, Hednesford, and District Gas Company, Limited, was reached last Tuesday, with the opening by the Chairman of the Company (Mr. William Jones) of an installation of eight Woodall-Duckham vertical retorts, arranged in four settings. There was at the ceremony a large attendance, which included a number of gas engineers from Midland towns. We have received from the Woodall-Duckham Vertical Retort and Oven Construction Company the following

DESCRIPTION OF THE PLANT.

The installation consists of eight vertical retorts arranged in four settings, each setting containing two retorts. Each pair of settings is built in one unit; but each setting is complete with its own producer and regenerator, and so arranged that either of the retorts may be worked singly.



The Installation of Woodall-Duckham Continuous Vertical Retorts at the Cannock Gas-Works.

The installation is guaranteed to give a total throughput of 40 tons of coal, and yield a total make of 500,000 cubic feet of gas per twenty-four hours, which guarantees have been exceeded in actual practice.

A straight joint is formed between each pair of settings forming one unit, and a straight wall is built between each setting, so that any one setting may be let-down or heated-up without interfering in any way with the neighbouring settings.

The coal required for the installation is discharged from the railway waggons on the existing railway siding, and falls into a small receiving hopper placed at the ground level at the foot of the railway embankment. This receiving hopper feeds the coal into a two-roll coal-breaker fitted underneath, and arranged to discharge broken coal on to an inclined tray conveyor, which takes the coal across the gas-works yard (over Podgy Lane) to the vertical retort installation upon the other side—at the same time elevating it to the level of the overhead storage hoppers above the settings. Here it is discharged on to a push-plate conveyor, which extends along the length of the overhead storage hoppers, and into which it discharges the coal. From these hoppers the coal is fed through a special type of valve into the two-hours auxiliary supply hoppers that are attached to the top mouthpiece of the retorts. From these auxiliary supply hoppers the coal falls, by gravity, into the retorts at a speed governed by the rate of extraction of the coke at the bottom.

Under the coke extractors, cast-iron hoppers are fitted for receiving a 2½ hours' make of coke. The bottoms of the hoppers are closed by a patent water-sealed door, which is opened by hand once every 2½ hours. The contents of the hoppers are discharged into suitable skips, which are run along on rails fixed in the retort-house floor.

For dealing with the coke required for the producers, the coke-skips are run into a lift placed at the end of the installation and elevated to the level of the overhead storage hoppers. On the top of these hoppers light rails are laid, along which the skips run, and discharge their contents into the various compartments provided.

From the storage hoppers the coke is fed directly through a shoot into the charging hole of the producer—the rate of flow from the shoot being regulated by a quadrant-type of valve. A second door (with quadrant-valve) is fitted to these overhead storage hoppers, so that by means of a light portable shoot the retorts can be filled with coke after scurfing.

For dealing with the coke not required for the producers, the coke-skips run from underneath the settings, through the end or side walls of the house, into the yard for storage at any convenient point.

The settings are supported on steel compound stanchions, filled in with concrete in such a way as to form a very substantial column. The stanchions are connected by longitudinal joists, upon which rest cross joists forming the floor of the settings. Substantial side and end buckstays, cross stiffeners, producer bracing, and all the necessary stairways, ladders, platforms, &c., are provided.

The coal and coke storage hoppers have a capacity equivalent to thirty hours' maximum consumption, and are fitted with sliding doors and extension pieces for feeding the coal into the auxiliary hoppers—the coke-hoppers being fitted with shoots for feeding coke into the producers, as already described. An extra door is also fitted to the coke-hoppers for filling the retorts, as required, after scurfing.

One brick-built main flue is provided on one side of the retort-house, of ample area to take the waste gases from the settings. It is supported on a concrete floor, carried from suitable steel channels, and braced by means of angles and round ties. It extends to the side wall of the retort-house, and is connected to a brick-built chimney, of sufficient area and height to provide the necessary draught for the efficient working of the installation.

All necessary furnace fittings, retort fittings, gas offtakes, hydraulic mains, foul mains, tar mains, and water services are provided in accordance with the latest designs of the Woodall-Duckham system. A retort-house governor is provided and connected to the foul main inside the retort-house.

The two-roll coal breaker, which is provided to break the coal required for the installation, is capable of reducing 25 tons of run-of-mine coal, to pieces not exceeding 2-inch cube, and is fitted complete with jigging screen, all necessary driving gear, fast-and-loose pulleys, &c., to receive a drive from a gas-engine. It is also provided with all necessary supporting steelwork—the breaker pit being covered with a chequer plate covering.

The inclined tray conveyor, which raises the coal to the level of the overhead storage hoppers, is of the roller type, and is capable of conveying and delivering 25 tons of broken coal per hour on to the push-plate conveyor, which is also of the same capacity, and which runs along the overhead storage hoppers and discharges the coal in the various compartments provided for its reception. The former conveyor is provided with all necessary supporting and covering steelwork, the portion that is over Podgy Lane being enclosed and fitted with removable plates, and supported at various lengths by steel trestles built-up from the ground level. The latter conveyor is also provided with all necessary supporting steelwork. The two conveyors are arranged to take a drive by means of vertical and horizontal shafting from a gas-engine.

One belt-driven lift is provided in one of the corner bays of the house, and is arranged to take coal and coke skips from the ground level up to the level of the overhead storage hoppers. The lift is capable of raising a load of 25 cwt. at a speed of about 60 feet per minute. Collapsible gates are provided at the ground level, clinker-stage level, top of setting level, and top of hopper level—all so arranged that the lift cannot be operated unless all the gates are closed.

For driving the extractors at the bottom of the retorts, two small gas-engines are provided, one of which acts as a stand-by in case of a breakdown to the other. The engines are arranged to drive a countershaft which runs across the end of the bench; the shaft being made to drive the two lines of reciprocating bars by means of adjustable eccentrics. These reciprocating bars run along the entire length of the bench, and are fitted with small connecting rods for driving the extractors under each retort.

For driving the coal and coke handling plant, one gas-engine is provided for driving the breaker, one for the elevator and push-plate conveyor, and one for the lift. They are complete with all necessary fittings. A suitable brick-built engine-house is provided near the breaker for installing the engine driving same. A further steel-framed engine-house is also provided nearest the retort-house, suitable for housing the engines driving the remainder of the plant. It is panelled with 4½-inch brickwork, and fitted with slated roof, suitable doorway, and window. The walls of the engine-house are tiled throughout on the inside with neat dado and moulding.

The retort-house consists of a steel-framed structure, braced together by suitable joists and channel stringers. The corner panels of the house are diagonally braced by means of flat ties. The walls are formed by filling in between the stanchions and stringers with 4½-inch brickwork reinforced every fourth course.

Suitable roof principals are pitched at 7 ft. 6 in. centres, on which angle purlins are laid to carry "Duchess" slating. Ventilators are also provided on the apex of the main roof, fitted with patent glazing bars and glazing. The lean-to roofs on each side of the main roof are also covered with the same material, and fitted with ventilators as before.

The floor of the house is paved with concrete, laid to a thickness of 6 feet. The concrete foundations for carrying the retort-house consist of a reinforced concrete raft, upon which the setting and retort-house stanchions are built.

The Opening Ceremony.

The company having assembled in the engine-house, Mr. W. J. Jones (on behalf of the Contractors) said they had now completed their contract to the satisfaction of the Company's Engineer (Mr. Walter Gregson); and he would ask Mr. William Jones to formally open the installation by starting the engine. Mr. William Jones promptly complied with this request; and for an hour those present spent an interesting and profitable time in inspecting the new plant, under the guidance of Messrs. Jones and Gregson. Light refreshments were afterwards served; and the party subsequently travelled to Birmingham.

On arriving there, luncheon was served at the Midland Hotel, Mr. William Jones (Chairman of the Company) presiding.

The toast of "The King" having later on been received with musical honours,

Mr. T. A. Hawkins, J.P. (a Director), gave the toast of "The Town and Trade of Cannock," and urged that capitalists were in honour and duty bound to see that those who laboured for them were well housed, and that their conditions of life were such as would make them happy. So far as the Cannock Gas Company were concerned, he recognized that they had a duty to perform; and he flattered himself that they had performed this duty, with credit to themselves. The Directors had realized their responsibilities to the public, and had endeavoured to give the best article for the least money.

Mr. W. H. Gallatley (Chairman of the Cannock Urban District Council), acknowledging the toast, said the new plant was a striking testimony to the foresight, power of initiative, enterprise, and sound judgment of the Directors.

Mr. W. Bach also replied, and remarked that, so far as the Cannock Gas-Works were concerned, they had a very nice undertaking. He did not believe there was any fear in a place like Cannock that they would get a works to provide electric light; but, personally, he thought the gas-works could compete with any electrical installation that could be brought into the district.

Alderman Goodyear (Chairman of the Smethwick Gas Committee) gave "The Cannock Gas Undertaking," and congratulated the Directors on their bold decision to instal the vertical retorts. Smethwick would never regret having adopted the system, believing, as they did, that it was absolutely necessary if they were to compete and hold their own with all-comers. The Directors of the Cannock Gas Company had placed themselves in a position to compete with any electricity undertaking that might come into their district.

Mr. William Jones responded, and said that, although everything seemed very simple and very plain to-day, the Cannock Gas Company had not found it all clear sailing during their career. Their position was a very peculiar one. They had to provide certain satisfaction for the shareholders who invested their money in the undertaking, and they also had to satisfy, as far as they could, the requirements of the customers. When representations were made respecting the price of gas, the Directors always gave them very serious consideration; and if they could by any means help their customers, they were only too willing to do so. At the same time, the customers must not lose sight of the fact that the shareholders had ventured their capital for the purpose of producing what was required in the district, and they looked for a return on what they had expended. Coal had increased by 5s. to 6s. a ton; and this represented, at least, an advance of 6d. per 1000 feet of gas. However, the Directors wished to avoid such a course as long as possible. They had bought their coal well, and were in hopes that between now and 1916 they would be able to supply all their customers. The new venture which had been inaugurated that day might be considered as the closing of the old volume of records of the Company, and the opening of a new one, which, he hoped, would be equally successful as, and perhaps more profitable than, the old one had been.

Mr. W. Greatorex (a Director), in complimentary terms, gave the toast of "The Visitors."

Mr. Vincent Hughes, responding, referred to the Smethwick installation, and said he was convinced they would never regret the step they had taken, because it was not only better for the consumers, but also for the men engaged at the works. The conditions under which the men now worked were very different from the dirt, filth, and smoke of the old system of gas making.

Mr. T. H. Hack also acknowledged the toast, and paid a warm tribute to the foresight and ability of the Directors of the Company. At Birmingham, he said, they went very carefully into the question of these vertical retorts, and came to the conclusion that they could not do better than instal them. Their expectations had been fully realized as regarded the plant.

Mr. S. E. Loxton (a Director) gave the toast of "The Engineers and Contractors," and said Messrs. Woodall and Duckham invented a system distinctly helpful to mankind. In the course of a eulogistic reference to Mr. Gregson (the Company's Engineer), he said he came to them under most difficult and trying circumstances, when the new retorts were to be erected; and he had taken a keen interest in, and an intelligent and businesslike view of, all they were doing. In him they were reposing absolute confidence.

Mr. Gregson, in returning thanks, spoke of the excellent manner in which the whole of the plant was organized by Messrs. Woodall and Duckham, whereby the Sub-Contractors worked together with the idea of giving them the plant complete by a specified time. It was also a remarkable fact that the whole of the material employed and used in the work of construction was so admirably designed that when it arrived at Cannock, it was merely a matter of erecting and bolting it together on the site. No difficulty had been experienced by him or any of the men in working the plant. The guarantee given by the Contractors to the Gas Company, to the effect that the plant should be capable of producing 500,000 cubic feet of gas of 15½-candle power—that was, carbonizing 40 tons of coal in 24 hours—had been easily fulfilled. He was pleased to speak of the happy relations which existed between the Contractors and themselves. He was convinced that, not only would the vertical retorts continue to give excellent results, but it would be many years before any vital alterations or repairs would be necessary to them.

Mr. W. J. Jones (of the Woodall-Duckham Company) next responded, and remarked that if Birmingham was satisfied with what they could give them, then the whole gas profession could safely follow their lead. He spoke appreciatively of the impartiality with which Mr. Gregson had carried out his duties as Engineer, and of the able manner in which Messrs. Gibbons Bros. and Messrs. Thomas Vale and Sons had carried out their respective contracts.

Mr. G. Bennett (Messrs. Gibbons Bros.) also replied, and said that his firm had been carrying out work for the Gas Company for the last 23 years.

The concluding toast was that of "The Chairman," which was accorded musical honours.

In honour of the occasion, the workmen of the Company were hospitably entertained.

ITALIAN GAS COMPANIES AND THE WAR.

It can well be believed that, for a variety of reasons, those responsible in these wholly exceptional times for the conduct of gas undertakings in Italy are by no means without anxiety. The country has no coal supply of its own, and is therefore entirely dependent upon importation from outside—principally from Great Britain. Uncertainty must naturally exist as to the possible continuity of supplies, though up to the present it is understood that Italy has been well favoured in this respect. Then there are doubts as to the cost of freights, the risks of loss, possible difficulties due to congestion at ports, shortage of railway trucks, labour problems, and over all is spread (like a threatening canopy) the anxious doubt as to the political situation and the growing darkening war clouds.

This situation is suggested by the annual report, which has recently reached us, of the Società Italiana per Il Gas—a Company which is concerned in the lighting of Turin, Bergamo, Tortona, Girgenti, and, indirectly, of other towns. "At first," says the report, "the consequences of the European war were not much felt. At the beginning of August, the works had abundant reserves; but an important supply, which had long before been arranged with English collieries, for delivery according to our needs, failed us, as the English contracts gave the right to the vendors to suspend shipments in case of war. After the first period of panic, during which prices rose exceptionally, largely owing to speculative operations, the market became more normal, and arrangements were made to maintain our supplies from various sources. In November the rise in freights began. Under normal conditions freightage from England was 7s. Now it rose to 40s., and coal which cost about 25 lire at the port of arrival now cost 70 to 75 lire." The report adds that any comment on this would be superfluous; and the hope is expressed that confidence can be placed in the Government in these grave circumstances to see that supplies are provided, so as to make possible the carrying on of the industry.

Perhaps we may in conclusion express sympathy with our Italian professional colleagues in the gas industry in the exceptional circumstances in which they find themselves placed, and trust that their widely recognized organizing and engineering abilities will enable them to overcome their great difficulties.

Association of Gas and Water Engineers of Austria and Hungary.

The programme of the thirty-fourth annual general meeting of this Association, which (as already announced in the "Journal") will be held at Vienna next month, has now been issued. The meeting will be opened on the 14th prox. by the President of the Association, Professor H. Strache, of Vienna. The sittings will take place in the offices of the Vienna Corporation Gas-Works. After the President's Inaugural Address, the following papers will be read: "The Future of the Gas Industry," by Herr W. Vaigl, Manager of the Pilsen Gas-Works, "The Utilization of Coke Breeze," by Herr Viktor Schön, Assistant Manager of the Budapest Gas-Works, "The Mundus Light," by Herr Paul La Ruelle, of Vienna. Various technical plants will be visited in the course of the afternoon; and on the following day, after private business (including the election of officers for the ensuing year, and the choice of a place for next year's meeting), a paper will be presented on "The Distribution of Gas in the Area Supplied by the Corporation Gas-Works," by Herr Alexander Kaiser, Chief Inspector of the Vienna Gas Undertaking. This will be followed by reports and discussions on novelties in the manufacture and use of gas, on its relation to hygiene, on water statistics, and on gas heating and the investigation of gas-cookers. Members will sup and dine together on the evenings of May 13, 14, and 15. The official announcement concludes with a request that they will bring their "bread tickets" with them on these occasions.

FRACTIONAL COLLECTION OF CRUDE TAR.

By GEORGE THOMSON PURVES, Assoc.M.Inst.C.E.

[A Paper read before the Scottish Section of the Society of Chemical Industry.]

IN the "JOURNAL" for the 2nd of February (p. 259), a short abstract was given of a paper, on the above-named subject, read by Mr. G. T. Purves, Assoc.M.Inst.C.E., of the Auchengeich Coke-Ovens, Chryston, Glasgow, before the Scottish Section of the Society of Chemical Industry. The author is the Vice-President of the Western District Section of the Scottish Junior Gas Association; and it may be in the recollection of readers that, an intimation having been given by the Council of the Institution of Gas Engineers that they would accept for their annual meeting last June a paper submitted by a Junior Association, the one sent in by Mr. Purves, "On the Application of Coke-Oven Carbonizing and 'Otto' Direct Ammonia Recovery to Gas-Works Requirements," was selected. The full text of his paper before the Society of Chemical Industry appears in the current number of their "Journal," from which it is reproduced with the report of the discussion upon it.

PREFATORY OBSERVATIONS.

The complete collection of crude tar in fractions does not appear to have received the attention which its importance justifies. Apart from the purely commercial aspect, it is worth considering how far the primary separation of the crude tar into the usual first fractions in the closed condensing system would be helpful to the reduction of atmospheric pollution. In some tar-works the gases evolved from the tar are burnt direct, and in others passed through purifiers. In the case of direct fractionation, this gas would go to augment the volume of permanent gas produced.

If the tar can be collected in the ordinary practice of the carbonizing work in those fractions into which the distiller ultimately splits it up, this would clearly be a desirable attainment, provided the cost of so doing is not excessive. And considering the cost in wages and fuel, and possibly transit, which the primary distillation in the tar-works involves, there would seem to be some considerable scope for the successful practice of direct fractionation.

It is a well-known fact that in the distillation of tar decomposition of certain products occur, and the content of free carbon is increased. I have distilled a sample of heavy crude tar which was liquid at ordinary temperature, but after remixing the fractions, warming, and allowing to cool, the product was solid, showing considerable alteration in the component products. Such a change in the tar might in some cases be beneficial, but in others would be objectionable. Direct fractional collection avoids the submission of the heavy tar to the high temperatures obtaining in the still towards the end of the distillation. The object in this paper, however, is to consider the question from the carbonizer's rather than the tar distiller's point of view.

In gas-works practice the crude gas from the retorts is very commonly drawn through a liquor seal in the hydraulic main, and here heavy pitchy tar is deposited. Later in the slow condensing main, then in the final coolers and tar-extractors, and lastly in the distribution system, lighter and lighter fractions are separated, in each case by cooling and frictional scrubbing. This is distinctly fractional separation of tar. Further, it would be a difficult matter to get other than fractional separation. But so little is it the intent that the carbonizer carefully runs his fractions into the common tar well.

FACTORS GOVERNING PRACTICE IN TAR EXTRACTION.

It will be interesting to consider one or two factors which have governed practice in tar extraction, and the effects of these on the gas, on bye-product recovery, and also on the trend of development towards complete direct fractionation. Before doing so, however, I wish to refer to a point in regard to the nature and the removal of tar fog. When the fog is first precipitated in the gas, it must be in an extremely fine state of division, and the question arises, How fine? In a recent descriptive paper on the "Electrical Separation of Tar from Gas" as applied at the Semet-Solvay Coking Installation, Detroit,* the following statement is made in referring to the paper-stain method of determining the amount of tar fog present in crude gas: "When the gas carries large quantities of tar mist the aspirator bottle will be full of the dense brown fog which has passed through the papers"—*i.e.*, two filter-papers. In the face of this, no practical tar-scrubber could be expected to remove such fog completely. At the actual moment of condensation, the minute drops of a liquid would all be of the same size, and consist of the smallest number of molecules which could satisfy the conditions of equilibrium for the liquid state.

In order to remove tar fog, it is necessary to allow sufficient time to elapse for the elementary liquid drops to agglomerate to the relatively very large drops which we are able to deal with in practice. The size of the globules will be increased not only by aggregation, but also by the solution in them of other vapours from the gas. I find a recognition of this principle in the work of Henry Aitken, a collaborator of William Young. In the Aitken process, patented in 1874, "the settling of tar fog was promoted by sending gas at 190° Fahr. into a very large settling chamber, and keeping it there for as long as possible at that temperature."† The conclusion I wish to draw from this is that tar fog cannot be simultaneously precipitated in the gas and removed by frictional means from it.

In former years, when the candle power of town's gas was higher than it is to-day, slow cooling of the gas was favoured, as a means of keeping-up this candle power by retaining in the gas as vapour a larger amount of the illuminating condensable hydrocarbons. In the Saxon industry, where lignite is carbonized for its valuable tar products, we find "the cooling effect is produced solely by external air; and it is important that the vapours should pass through as long a track of tubing as possible. It has been found that if the vapours are artificially cooled (by water) in a short condenser to the same temperature as is attained in the atmospheric condenser, they still contain condensable constituents; whereas these are almost entirely absent when air is used. The most important point in the condensing process is the gradual cooling."* Exactly opposite results are thus apparently claimed for the same operation.

As the crude gas from the retorts cools down, its dew-points with respect to different hydrocarbons, &c., are reached one after another, and the substances settle-out as constituents of tar fog. The minute drops comprising the fog float in the gas for a considerable time, depending largely on their specific gravity and the amount of frictional resistance encountered. This tar fog has a solvent action on those hydrocarbons, &c., still present in the gas as vapours, provided the temperature is not above their boiling-points; and it will dissolve a proportion even when the gas has not cooled-down to its dew-point with respect to the particular substance. If the fog remained in the gas for a sufficient time, a state of equilibrium as regards solution would be established when the vapour pressure of the substance in the fog equalled the partial pressure of the substance in the gas. Hence by passing the gas through a slow-condensing main where the fog globules will coalesce and settle-out of the gas slowly, the gas is largely denuded of its light oil constituents, as is claimed in the lignite industry. Lignite carbonizing being a low-temperature process, a considerable proportion of the tar produced is very light specifically, and so the fog slowly settles from the gas.

The explanation of how the slow-condensing main of the gas-works helps to keep the lighter hydrocarbons in the gas is to be found partly in the nature of the tar produced, but more largely in the higher outlet temperatures at which the slow-condensing main is operated. By fractionally collecting the tar, I found in a particular test that the gas produced was capable of carrying as vapour at atmospheric temperature and pressure all the light oil produced. The cooled gas contained 3·5 per cent. of hydrocarbons absorbable by fuming sulphuric acid. All the tar present as fog at 80° C. was scrubbed-out, and amounted to about 2·75 per cent. of the weight of coal carbonized, and contained only a trace of solvent naphtha. By further quick cooling and scrubbing in cold water sprays to about 20° C., some 0·13 per cent. of crude naphthalene crystals is obtained. So that by the time the gas has cooled to 80° C., about 95·5 per cent. of the tar which has to be removed by the extractors has separated out as fog. If now such a crude gas at 80° C. were passed through a slow-condensing main, the fog would be steadily removed while the gas cooled relatively very little; and so the tar fog would have a much reduced opportunity of exerting any solvent action on the hydrocarbon vapours in the gas, with the result that these would be largely retained by the gas, and the candle-power enhanced. As the temperature at which the slow-condensing main is operated is lowered, increasing amounts of benzene vapour, &c., would be removed from the gas. It is probable, however, that at temperatures even much lower than 80° C. little benzene would be removed, for the gas is considerably below the saturation-point with regard to this vapour.

The principle involved is clearly the retarded cooling of the gas while the bulk of the tar fog is removed. The time occupied in the operation does not appear to be a material factor. The ideal state would be the complete removal of all tar fog before the gas reached the temperature at which the light hydrocarbons would be dissolved. This is fractional tar collection in a degree. Professor Lewes writes: "It was realized that sudden cooling of the gas and condensation at too early a period affected the illuminating power more than slow cooling. This is partly due to the

* See "JOURNAL," Vol. CXXVIII, p. 309.

† "William Young: An Appreciation." By Dr. Alfred Daniel. See "JOURNAL," Vol. CXV., p. 648.

* "Shale Oils and Tars." By Dr. W. Scheithauer.

tar being thrown out as a whole, while with slow cooling some of the benzene is carried away as vapour by the gas, &c."* It is not, however, speed of cooling, but rather one of time-contact between tar fog and cooled gas, that is the material factor. For, as has been shown above, the crude gas can be quickly cooled, and the condensable tar removed almost wholly in one and completely in two operations, with practically no removal of benzene. At the Granton Gas-Works, the slow-condensing main is upon the counter-current principle; and so the condensed tar has the minimum opportunity for solvent action on the gas. The slow-condensing main at the Greenock Gas-Works is on the direct-current principle; and so the condensed tar has here the maximum opportunity for solvent action on the gas.

The important point in the working of the slow-condensing main is that the outlet temperature shall not be low enough to permit of the benzene, &c., being absorbed. Dr. H. G. Colman, when working on the removal of the heavy tar fog from the hot gas (about the year 1897), had two special objects in view—first, to remove the naphthalene more completely from the gas in the condensers, and, secondly, to retain more of the vapours of the light oils in the gas, and thereby increase the illuminating power. To effect these results, one factor which he proposed was to pass the hot gas through a "Cyclone" extractor. The gyratory motion imparted to the gas in such an apparatus causes a centrifugal action which is much greater in the case of the tar drops than in that of the surrounding gas, owing to their higher specific gravity. The tar drops are therefore thrown to the periphery of the centrifugal separator, where they coalesce and can be drained away. With the ratio of naphthalene to light oils obtaining in those days, these objects were achieved. But with the larger production of naphthalene in later carbonizing practice, it was found that the crude naphthalene, &c., came down in a semi-solid mass in the condensers and blocked them. In Dr. Colman's method, partial tar fractionation was thus used as a means of overcoming two definite carbonizing troubles,

Work of Young, Hilgenstock, Feld, and Davidson.

As we would expect, the writings of William Young are rich in reference to fractional condensation of tar. In the Young and Aitken process, the central feature was the analyzer, in which fractional condensation was carried out. No effort was made, however, to collect separately the tar fractions deposited in the different sections of the analyzer. The tar was allowed to flow downwards from section to section, so allowing the gas to take up as much of the lighter constituents of the tar as possible—this being the principal intention of the process. Fractional condensation with a counter-current flow of condensed products thus took the place of sending the gas and condensed products in the same direction. In an address Mr. Young gave to the West of Scotland Association in 1876 on "Condensation," he showed that, to retain the highest lighting value in the gas, we must keep the gas and condensed tar warm until they have physically separated; and in order that the tar particles may settle-out the crude gas must be kept warm and be allowed to travel slowly, and, further, that the tar be allowed to cease contact with the gas only at such a temperature that it could not absorb the lighter hydrocarbons. In other words, there must be the shortest time-contact between condensed tar and cooled gas. It will be shown later that all this is effected in complete fractional tar collection. In later years, when the ratio of naphthalene to light oils in the gas had largely increased, Mr. Young abandoned the principle of the Aitken and Young process on account of the fact that when it was applied the cooled gas was saturated with naphthalene vapour. With possibly the exception of the gas produced in continuous vertical retorts, complete tar fractionation will always leave the gas saturated with naphthalene vapour when a high carbonizing temperature is applied.

The failure of Brunck's direct ammonia-recovery process was principally due to the presence of large deposits of tar in the saturator, resulting in highly discoloured and unmarketable sulphate. This difficulty was overcome in the Koppers semi-direct process by cooling-down the gas, then removing the tar, and after reheating the gas passing it through the saturator. Reverting to the original idea of Brunck, Dr. Hilgenstock, of the Otto Company, perfected his process of scrubbing the crude gas with a spray of hot tar, and so completely removing the tar fog without cooling the gas below its dew-point temperature with regard to water, then passing it through the saturator. After passing the saturator, naphthalene and light oils are removed by cooling and scrubbing with creosote oil. In the Simon-Carvès direct-recovery process, before the gas reaches the saturator, tar is removed in two separate fractions, based principally upon their different specific gravities, but also partly on different temperatures. The first is removed in a "Cyclone," on similar lines to that used by Dr. Colman (Messrs. Henry Simon owned the original patent rights of the "Cyclone" dust collector), and the second in a patent "dynamic extractor," where a more intense centrifugal action is used, and the remaining tar fog completely removed from the gas. We thus see that the success of the direct ammonia-recovery process is dependent on the fractional separation of the tar.

In 1907, Walther Feld proposed to scrub the crude gas in his patent washers successively at 160°, 80°, and 60° C., and so obtain (as separate fractions) pitch, a heavy oil, and a lighter oil. He further developed his process to include the extraction from the gas of naphthalene, ammonia, and cyanide, &c. His process is applied at a number of Continental gas-works; but I do not know with how much success. To get the first (the pitch) fraction, the gas from the collecting main is passed through heat-insulated pipes into the first washer at a temperature from 200° to 160° C. This latter temperature is given by Feld as the dew-point temperature of the high-boiling-point hydrocarbons constituting the pitch. The washing oil in the upper part of the washer is a solution of pitch in a portion of the next condensate, and in the bottom chambers the pitch fraction itself. Before the gas enters this washer it must have deposited an almost solid pitch containing a large proportion of the free carbon. It is difficult to see how this can be worked-up with the true pitch fraction on the lines of the Feld process. This appears to be borne out to some extent by the fact that soft pitch produced by the process contains only from 1 to 3 per cent. of fixed carbon, which is less than is usually found in crude tar. If the crude gas enters the first washer at the higher temperature, and the fall of 40° C. takes place in there, it is fairly certain that some of the fog then produced would pass this washer, and so lower the efficiency of the fractionation. This difficulty would be experienced in each washer where a fall of temperature occurred. Such a procedure is, in fact, attempting simultaneous production and removal of fog. Feld seems to have expected, or else found, this difficulty, for he proposed to improve the fractionation, and to lower the temperature of the gas at one stage by pumping into it a portion of the product extracted at a later stage. This on evaporating would leave behind some of the former fraction which had been carried forward. In this way he no doubt partially helps the fractionation.

Two years ago Dr. Davidson expressed the view that the partial fractionation of the tar by the sensible heat of the crude gas could be simply effected on vertical retort and coke-oven installations.* He also described a method of producing in the gas-collecting main, in addition to the crude tar, a distinct and marketable pitch fraction which would certainly be lower in free carbon than that obtained in ordinary practice. Briefly, his method is as follows: In the collecting main of the Dessau retorts an agitator works continuously. A few minutes before the draw, tar is run into the main to a depth of 10½ inches, and when the charging of the nine retorts is complete the level of the tar in the main is brought down to 4 inches. During the ensuing carbonizing period, the remaining tar, due to addition of pitch from the gas and to distillation, is converted into pitch, which at the high temperature of the main (350° Fahr.) is liquid. By regulating the amount of tar added and run off, a soft or hard pitch may be obtained free from ammonium chloride. Obviously tar fog carrying free carbon will pass from the collecting main to the condensing system, and so the whole pitch fraction will not be obtained. Undoubtedly, however, a distinct pitch fraction is produced. It will be noticed that the temperature in the Dessau main (350° Fahr.) is much below the final temperatures obtaining in tar-stills, and so the process is more one of evaporation than distillation. In my opinion, Dr. Davidson's collecting-main method of producing the pitch fraction is superior to Feld's.

The "Cava" Process.

In the "Cava" process† for the distillation of tar the highest temperature to which the tar is subjected is from 200° to 250° C., according to whether a soft or a hard pitch is required. In this process the distillation—or, more correctly, evaporation—of the tar is effected by passing heated air over the tar contained in a horizontal retort. Blades mounted on a revolving central shaft plunge into the tar and expose thin layers of it to the oxidizing and evaporating action of the brisk current of air. Some of the lighter products are oxidized, and so the amount of the bituminous substances in the pitch increases, and likewise the yield of pitch; and it is claimed that on account of the low working temperature there is no increase in free carbon. The evaporated products are condensed and treated in the usual way. Dr. Davidson's method involves at least the principle of the "Cava" process; but the separation of the tar products is limited to the pitch fraction, and this is not quite all recovered.

The Author's Method of Direct Fractionation.

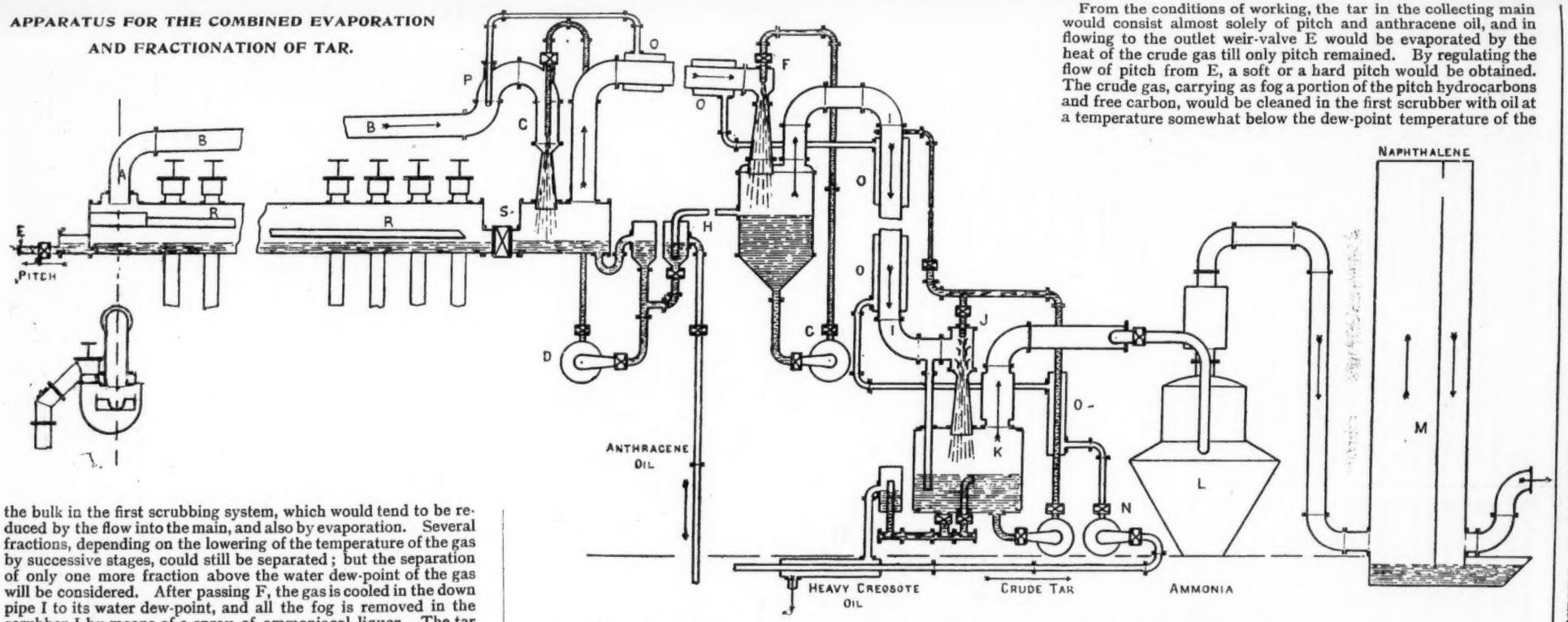
In order to carry out the complete direct fractionation of the tar within the condensing system, and also the evaporation and fractionation of a further quantity of crude tar by means of the sensible heat of the crude gas, I would suggest the following method, using the plant indicated diagrammatically in the accompanying illustration. Briefly, the method is as follows: The crude gas from the collecting main passes by the upstand pipe A and the foul main B to the scrubber C. Here the gas is scrubbed by a screen of anthracene oil containing some pitch; and all the tar fog containing the free carbon is removed. The oil, &c., collecting in the receiver below flows to the pump D, to be recirculated; and there is also a continuous flow of the oil into the collecting main. The amount passing would be just what is necessary to maintain the bulk in the main, which would tend to decrease by the removal of pitch at E, and by evaporation. The gas passing C, after further partial cooling, is scrubbed in F for the removal of anthracene oil. The oil collecting in the receiver here is circulated by the pump G, and all the surplus flows to the pot H, and from there to the storage. The pot being in communication with the inlet to the pump D allows the anthracene oil to keep up

* "The Carbonization of Coal." By Vivian B. Lewes, F.C.S.

* See "Journal," Vol. CXXVI., p. 109.

† British Patent No. 29,897 of 1912.

APPARATUS FOR THE COMBINED EVAPORATION AND FRACTIONATION OF TAR.



the bulk in the first scrubbing system, which would tend to be reduced by the flow into the main, and also by evaporation. Several fractions, depending on the lowering of the temperature of the gas by successive stages, could still be separated; but the separation of only one more fraction above the water dew-point of the gas will be considered. After passing F, the gas is cooled in the down pipe I to its water dew-point, and all the fog is removed in the scrubber J by means of a spray of ammoniacal liquor. The tar oil collects in the receiver K, separates from the liquor, and then flows to the storage. The liquor remains in the circulating system. The gas, completely freed from tar fog, but still carrying all the water as vapour, is passed without further cooling through the direct-recovery saturator L, where the ammonia is removed. It is then quickly cooled in one section of M, and naphthalene removed in the other. The naphthalene collects in the settling-tank beneath as crude crystals. The gas now passes through the exhauster, and is forced through the usual creosote scrubbers for the recovery of benzol, &c.

As has been stated, the crude gas is successively cooled between the different scrubbing systems. This is partly done by air cooling, but also, as far as possible, by an externally applied countercurrent flow of crude tar brought in from other carbonizing installations. This tar is forced by the pump N through the successive heat exchangers O into the foul main at its highest point P. It would now flow down against the crude gas, cooling it and being itself further heated. It would here yield up to the gas the bulk of its lighter constituents, and finally reach the gas-collecting main by the open tray R.

The work which has been done in the "Cava" process and by Dr. Davidson shows how simple and practical it is to produce pitch in such a vessel as the collecting main; it is sometimes too easy. In both these methods the hot pitchy tar is kept mixed by mechanical agitators. This is not difficult in a short main such as is used with the Dessau retorts or in the "Cava" still, which is only about 6 metres (19 ft. 8 in.) in length; but when dealing with (say) a 60-oven coking plant, having a collecting main about 200 feet long, it is quite a different matter. To obtain the necessary agitation here several jets of high-pressure steam blowing into the body of the liquid tar would be effective. Very little steam would be required, and after doing its work would pass away with the gas and be finally condensed.

The gas leaving the collecting main of a coke-oven installation may reach 300° C. The temperature to which the gas must be reduced before reaching the first scrubber is about 150° to 170° C.—a reduction would be largely effected by the crude tar entering the foul main at P, partly by external air. It would probably be advantageous to lag these mains, and use all the sensible heat of the gas for heating and evaporating added tar. The oil from the first scrubber, flowing in by the sluice-valve S, mixes with the highly heated tar in the collecting main.

From the conditions of working, the tar in the collecting main would consist almost solely of pitch and anthracene oil, and in flowing to the outlet weir-valve E would be evaporated by the heat of the crude gas till only pitch remained. By regulating the flow of pitch from E, a soft or a hard pitch would be obtained. The crude gas, carrying as fog a portion of the pitch hydrocarbons and free carbon, would be cleaned in the first scrubber with oil at a temperature somewhat below the dew-point temperature of the gas with regard to the lowest boiling compound of the pitch fraction. The gas temperature would vary with the conditions of carbonizing, with the nature of the pitch required, and with the amount of added tar evaporated. Without added tar, it would probably be about 150° C.; with added tar, however, the dew-point temperature would rise corresponding to the richness of the added tar in the lower boiling-point members of the pitch fraction required. It is quite possible, therefore, that the proper working temperature at this point would vary by 20° or 30° C. between the conditions of working hard pitch with added tar and soft pitch without added tar. The lowest temperature at which this section could be worked would be that which would just maintain the oil level in the receiver.

The type of scrubber proposed for cleaning the gas here is the Otto spray, but using instead of crude tar the fraction here collected. A large proportion of the pitch fraction is deposited from the gas in the collecting main, and the balance would be extracted in the first scrubber. This balance dissolves in the scrubbing oil and flows continuously into the collecting main. With these conditions the pitch fog is removed—not with the pitch fraction itself, but with a solution of a portion of the same dissolved in anthra-

cene oil. This oil when sprayed through the gas in the scrubber would be partly evaporated and collected in the next scrubbing section. The temperature of the gas is lowered by this evaporation, and more fog is produced. But I have determined by experiment that the bulk of this fog goes forward with the gas. The time during which the fog remains in the spray after its formation is too short for the drops to get big enough for extraction. The oil carrying the pitch into the collecting main is evaporated, and comes down again in the condensing systems. There is thus a continuous circulation of anthracene oil carrying the balance of the pitch fraction back to the collecting main. An issuing pressure of 20 lbs. per square inch would be sufficient in the first scrubber; this pressure being raised in a pump of the "Albany" or the "Drum" type.

The gas from the first scrubber is now cooled as explained above to the dew-point temperature for the anthracene oil fraction, and scrubbed with this oil. The oil flows through the pot H to the storage. Since the pot is connected to the inlet of the first scrubber pump, the oil will naturally keep up the bulk in the first section. In this way the temperature of the scrubbing oil in the first scrubber will be lower than the temperature of the gas which it has to clean. As the temperature falls, I have found the fog which is produced more and more difficult to extract. But I consider a spray pressure of 30 lbs. per square inch would be sufficient in this section. The extraction temperature here would likewise vary with the carbonizing conditions, but would be somewhat over 100° C.

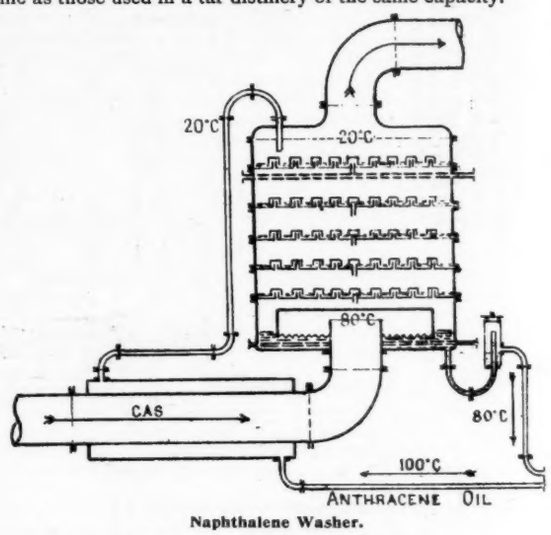
The gas now enters the down pipe I at a temperature of at least a few degrees above the temperature at which ammonium chloride deposits occur—about 93° C. It is cooled by the external counter-current flow of tar as already described and also by ammoniacal liquor sprayed into it, which dissolves the ammonium chloride formed and so prevents deposits of the salt. The liquor returns to the receiver by the sealed dip-pipe. In cooling the gas it will become itself heated above the working temperature, and this is corrected in the heat exchanger. The gas, now cooled to its dew-point with regard to water, is scrubbed in J by a jet of ammoniacal liquor at about 90 lbs. per square inch pressure. This high pressure is necessary to extract the lightest fog. For the first two sections, the Otto spray scrubber was suggested, and the method of operation is very similar to the usual practice—using, however, different scrubbing fluids. For the third section, in order to utilize the work done on the gas by the high-pressure jet, I think that the best type of scrubber would be one designed on similar lines to the Körting ejector condenser. This would reduce considerably the work to be done by the exhauster. In the receiver K the tar oil would separate from the scrubbing liquor, and float on the top of it, finally passing away by the overflow to the storage as a heavy creosote oil. The liquor would remain in the circulating system.

During the past year or two, I have made on the Auchengeich direct-recovery plant a number of experiments with the Otto spray tar extractor, and, using creosote oil, liquor, and tar and liquor mixed at varying temperatures, I have obtained efficient tar extraction. The most important point is to ensure that the fog which is to be extracted is present in the gas before it reaches the scrubber. The extraction temperature in this section would be from 70° to 80° C. according to the carbonizing conditions. From this point the gas is treated in normal direct-recovery manner. For instance, it is first freed from ammonia in the direct-recovery saturator L, and then naphthalene is removed in (say) an Otto water-spray naphthalene extractor M. The gas is then forced by the exhausters through the usual creosote scrubbers to recover the light oils. If the gas was required for town lighting, however, purifiers would take the place of the creosote scrubbers. In this particular case, it is to be remembered that the gas would be saturated with naphthalene vapour, and any fall of temperature would cause a deposition.

The content of naphthalene could be reduced by anthracene oil in the following way, somewhat on the lines of the Young and Aitken process, and using the plant shown diagrammatically in the following illustration.

The cooled gas, or a proportion of the total bulk, after being heated to 80° C., passes into the bottom chamber of a washer similar in principle to the Young and Aitken analyzer. Exhaust steam, or the sensible heat of the recovered tar fractions, or both, could be used for this heating. This is not indicated in the diagram, but a heat exchanger is shown in which the washing oil is cooled from its recovery temperature to that of the gas, the gas being itself partly heated. The cooled anthracene oil fills each of the trays up to the level of the overflow and runs through the washer in a continuous stream. In the bottom of the washer the oil is maintained by means of a steam-coil at 80° C., at which temperature it leaves the washer. At 80° C. the anthracene oil cannot dissolve benzene, and, in fact, so far as examination of direct-recovery tar extracted at this temperature indicates, very little solvent naphtha even is removed from the gas. This is no doubt due to the fact that the light oil vapours are far from saturating the warm gas. It is quite likely, therefore, that such a washer could be operated considerably below 80° C. without any material effect on the benzene content in the gas; the lowest practical temperature could be found only by experiment. This oil outlet temperature being much below the boiling-point of naphthalene, the anthracene oil will dissolve some of this hydrocarbon. The cold anthracene oil falling from tray to tray will be heated by the gas to 80° C. and the gas cooled. To ensure the gas being in contact with the oil at atmospheric temperature in the final tray, a cold-water coil is placed in the gas space under the top tray. When the oil in the washer is saturated with benzene either by admixture or by extraction from the gas, no further action on the benzene in the gas can take place.

Referring again to the larger diagram, the plant from the third scrubber on is already applied in the direct ammonia recovery process, so that it is only the part between the collecting main and this third scrubber which is added to the ordinary direct ammonia recovery plant for the fractionation of the tar. The cost of this addition, together with the plant for dealing with the in-brought tar, for an installation carbonizing 360 tons of coal per day, would probably not exceed £3000, and would serve for the fractionation of all the tar produced and added. The in-brought tar which could be dealt with might possibly reach 75 per cent. of that produced from the coal carbonized. The main attendants already required on such a coking installation could look after the two extra pumping sets, &c. The storage-tanks required would be the same as those used in a tar distillery of the same capacity.



Naphthalene Washer.

On account of the increased demand for benzene and toluene at the present time, there is added interest in the fractional method of recovering the tar products. In the ordinary condensing practice, these products are divided between the tar and the cooled gas; so that, to recover the whole of each, washing of the gas and also distillation of the tar must be resorted to. With direct fractionation, only one operation—the washing of the gas—is required. Anything tending to increase the output of toluene, either by better recovery methods or by increased production per ton of coal carbonized, is highly desirable now, not only on account of the better financial return, but also on account of national needs. The required conditions in carbonizing would seem to be such as would give a high partial pressure of methane at the moment of destructive distillation. From some experiments I have made on ammonia production in bulk carbonization, I consider the ratio of toluene to benzene produced will follow the yield of ammonia.

Conclusion.

I have endeavoured to show that, in many of the special methods applied for the extraction of the tar, fractional separation has been an underlying factor. The condition "that the tar should leave contact with the gas only at such a temperature that it could not dissolve the light oils," which Mr. Young stated in 1876, is fulfilled in direct tar fractionation. Mr. Young abandoned the principle of the Young and Aitken process on account of the trouble with the condensers, &c., due to the greater amount of naphthalene produced in later carbonizing practice; but, as I have already indicated, an extended application of this principle, using naphthalene-free anthracene oil, would overcome the difficulty. I consider that the method advocated by William Young so many years ago is still the correct one for gas-works condensation practice, and particularly so with carbonization in continuous vertical retorts. In a number of works using these retorts, surprisingly low candle power of the gas has been found, on account of the light tar fog persisting with the gas till almost the final stages of cooling, and so removing from it illuminating hydrocarbons.

DISCUSSION.

Mr. James M'Leod (Greenock) said, in regard to counter-current *versus* direct-current flow in condensation, that it was really a question of temperature. There was only a thin trickle of liquor and tar running down the slow-condensing main, so that the actual contact was comparatively slight; and there could be no very great scrubbing action. Hence, provided the temperature did not fall—and in Greenock it did not drop below 140°—whether there were direct-current or counter-current flow did not make much difference. In the Greenock Gas-Works, the naphthalene problem had been solved by putting down a separate washer with special washing oil; and, in addition, vaporizing a little oil of low

boiling-point into the gas after washing was finished. The system described by Mr. Purves was, however, a simpler process.

Mr. D. Vass (Perth) thought there would be a saving of the fuel required to re-heat the tar. To apply the system to gas-works would involve a serious alteration in the mains.

Professor Thomas Gray (Glasgow) said the method proposed by Mr. Purves for the fractional condensation of coal tar appeared to be quite practicable. It involved no new principle, as the method of separating liquids by bringing their vapours into equilibrium with condensates at different temperatures had long been practised in column stills; and the method which was proposed for establishing this equilibrium was one which had been in regular use for several years in connection with the Otto direct system of recovering bye-products from coal distilled in coke-ovens. He found it difficult to accept Mr. Purves' statement that the work in connection with the plant—involving as it did the regulation of temperatures in a somewhat elaborate system of heat interchangers—could be supervised by the same operative who took charge of the simpler Otto plant. In order to ensure uniform results in practice, it would be necessary to exercise very careful supervision, and to employ more highly skilled labour. It would be interesting to have estimates of the cost of installation, upkeep, and working of a plant of the size proposed, to compare with the corresponding figures for a plant designed to collect the tar in one fraction, combined with stills for distilling 15 tons of tar per day. While Mr. Purves was not in a position to state actual figures, he might be able to give some indication of the working costs from his experience in handling the Otto plant.

Mr. Moore said he had seen Feld's first plant in operation in Austria about six years ago, and it had failed, not because the process of condensation was a failure, but because in Austria they could not use the products, and, on account of duty charges, could not send them into Germany. Since then he had seen Feld's process successfully at work in that country. It could produce pitch quite easily with a melting-point varying from 70° to 90° C. He considered the plant proposed by Mr. Purves would prove difficult to work as at present arranged; and he saw no reason why a much simpler plant, after the style of the bubble washer, could not be used. This washer would require considerable pressure to force the vapour through the columns; but he thought the same result would be obtained.

Mr. W. H. Coleman (Manchester) asked whether the various condensates were obtained in a marketable condition. If they had to be distilled before they could be sold, it was questionable whether it would not be more profitable to collect the whole in one fraction and distil at once, rather than collect and distil them separately. He would like to know exactly what Mr. Purves meant by the statement that the yield of toluene followed the yield of ammonia. He thought he was right in saying that the yield of toluene decreased as the temperature increased—that was to say, when carbonizing at a higher temperature the tar contained larger quantities of benzene than low-temperature tar. He had examined some hundreds of samples recovered from coke-ovens, and, on an average, there was three times as much toluene per ton of coal in the gas as there was in the tar recovered from the ton of coal; so that if all the toluene were recovered from the gas there would be very nearly enough for the purposes for which it was required to-day.

Mr. Robertson remarked that if the main were used for the purpose of making pitch, its life would be greatly reduced, owing to the much higher temperature and the serious trouble that might arise from the presence of ammonium chloride in the tar. This substance, when distilled, acted strongly upon iron. With such a long main, having regard to the danger of pitching-up, due to irregular working and the fluctuating atmospheric temperatures, it would be difficult to keep the main at the requisite high temperature, and these difficulties would very much hinder the proper working of the coke-ovens. By using steam to keep the pitch liquid, more water vapour would be carried away by the gas, and would be condensed out again on cooling the gas to remove the naphthalene—thus increasing the quantity of waste liquor to be dealt with. Mr. Purves had said that the benzol was divided equally between the tar and the gas—95 per cent. existed in the gas, and the remaining 5 per cent. in the tar.

The Chairman (Mr. Robert Hamilton) said the process proposed by Mr. Purves was rather a delicate one in respect of the balance that must be attained, and maintained, between the amount of heat carried into the condensing system, and the cooling effects of that system. A difficulty which might upset all calculations was variation in atmospheric conditions. At any season of the year there might within a few hours be a considerable variation in conditions caused by a change from wet and stormy to dry still weather. Moreover, he would expect a different rate of working necessary as between summer time and winter time. Manufacturers of pitch were asked to make it in various states of hardness. Some of it was wanted so soft as to be really thick tar; while, from the States, there was a demand for a quality so hard that it had lost all plastic qualities, and had become a very brittle substance. To produce such differences in hardness must call for great variation in the conditions of working, and he should be very doubtful whether these extreme varieties could be produced by the proposed process. He did not think the "Cava" process would be a good one for distilling tar, because the evaporation was done by means of heated air; some of the products were oxidized, and a larger yield of pitch obtained. His own experience of blowing air through heated tar was that the free carbon was increased, and the plastic and cohesive properties of the pitch were impaired; so he should not expect to obtain a good quality of pitch from the "Cava" process. The principle might, however, be usefully applied if hot gas could be used as in the hydraulic main. Mr. Purves proposed to wash-out naphthalene with anthracene oil kept at a sufficient temperature to leave the benzol in the gas. But this seemed to him to depend upon a rather narrow margin; and he thought it would be simpler to wash-out everything, and then put back sufficient benzol to give the illuminating power required. By working in this way it was possible that the purification of the gas would be assisted. For instance, by washing with blast-furnace oil, which was quite an excellent solvent for naphthalene, benzol, and carbon bisulphide, it might be possible to remove practically the whole of these substances.

Mr. Purves, in reply, agreed with Mr. M'Leod that it mattered little whether the slow-condensing main was on the direct-current or the counter-current principle. The effect on the gas of the small quantity of condensed tar in the main was trivial compared with that of the tar fog. With regard to the suggestion made for dealing with the naphthalene problem, his intention was to show that an extended application of Young's counter-current condensing practice would overcome the principal difficulty which had caused him to abandon his process. In addition to the saving in fuel which successful direct fractionation would effect, the fractionation of added tar from other carbonizing plants would yield a further fuel economy. Professor Vivian Lewes had quoted, in his "Carbonization of Coal," 9·2 per cent. as the proportion of the heat applied in carbonization, which was carried away by the gas, tar, and water. In coke-oven practice with wet coal, the proportion was probably somewhat higher. As Dr. Gray had stated, the method proposed for the fractional collection of the tar involved no new principle; it was all covered by the work of William Young. The application of fractional tar collection in modern practice was, however, almost wholly the work of foreign chemists, as witness the Feld process and the direct and semi-direct ammonia recovery processes. It appeared to be well worth while to have a discussion on the subject by their own chemists. He selected the Otto tar spray for the removal of the tar fog because, after practical experience with several types of tar-fog extractors, he considered it easily the best. The regulation of the temperature of the gas to the water dew-point, as was required in the Otto process, was quite simple, and was done by the man in charge of the exhausters. The controlling of the other two temperatures could well be done by the "main" attendants, as their ordinary duties would be done away with in such a process as this. As Mr. Moore had remarked, the benzene and toluene were not fractionally condensed. He would draw a very distinct line between condensation and absorption by tar. These two products, benzene and toluene, were not, properly speaking, condensation products. Since the permanent gas was quite able to carry the whole of each by saturation at ordinary temperatures, the presence of them in the crude tar was entirely due to solution—the gas and tar having cooled sufficiently in contact with each other. He did not share Mr. Moore's opinion of the equal suitability of bubble washers. With a large bubble washer it would be more difficult to maintain constant temperature with a simple tar spray. The fractions obtained in direct fractionation would differ somewhat from those obtained in the ordinary tar distillation and partial destructive distillation process. Comparing the products solely within the scope of direct fractionation, he would hardly expect a difference of a few degrees in the extraction temperature to make any material difference in the composition of the product. He had not actually obtained all these condensates. The process was really only a suggested one; but judging from those fractions which had been obtained, and from the efficiency of the tar-extractor, he was confident that the fractional separation of the products would be quite clean. For instance, the anthracene oil would not be contaminated with the tarry matter of the previous fraction. The heavy tars were more easily separated than the lighter ones. After scrubbing the hot crude gas with a hot tar spray, he had seen the sulphate produced by the direct method snow white, and later the naphthalene extracted bright yellow in colour. The melting-point range of the latter was found to be 69° to 72° C., as against 70° to 73° C. for that separated from creosote in a tar distillery. He agreed that the future of such a process would depend upon the cleanness of the fractionation. In regard to the yield of toluene, he did not mean that the conditions which would give the highest possible yield of ammonia would also give the highest possible yield of toluene. In order to get the greatest commercial return from a carbonizing plant, it was necessary to work within a certain range of temperature and other conditions. Within this range the yield of ammonia varied in the same direction as the yield of methane. As a high partial pressure of methane at the time of carbonizing would seem to be the required condition for good yields of toluene, he would expect the ratio of toluene to benzene produced to vary in the same direction as that of the ammonia and the methane. The ratio Mr. Coleman gave for toluene in the gas to that in the tar was, he thought, much too low. It, however, might be anything, as it was purely a function of the method of condensation. The temperature in the main would not be higher than that already found in mains without dip-pipes and working with all tar conditions. As to possible corrosion from ammonium chloride, he thought too much was generally made of this factor, and he could not agree that any corrosion at all would result. At

the high temperature occurring here, ammonium chloride would not exist at all as such, and its free radicals would not combine until the temperature fell to somewhat under 100° C. The free hydrochloric acid could not corrode the iron, as the crude gas was dry until the temperature fell and the water dew-point was between 60° and 75° C. Once formed and dissolved, the chloride was always present in excess of ammonia; and as there was no question of dissociation, there was no evidence of internal chloride corrosion in the plant after fully four years' continuous working. There would be no greater danger of pitching-up than there was with other collecting mains working under all tar conditions; and the problem was not to keep the main at the requisite high temperature, but rather to bring the temperature down. The use of steam in the collecting main would certainly increase the amount of condensate ultimately produced; but this condensate was not a noxious product such as was produced from ammonia stills. He did not say that the benzol was equally divided between gas and tar. He thought the proportion stated by Mr. Robertson was about correct. With direct-recovery practice, however, no benzol, &c., occurred in the tar. He understood that, if proper care were taken in the working of the "Cava" process, no increase of free carbon occurred. The washing of the gas to free it partly from naphthalene, as carried out in gas-works, was done solely to reduce the tendency to choking in the distribution system; and simple washing was cheaper than combined washing and distillation of the absorbing oil.

IMPROVED INCLINED GAS-RETORTS.

Hitherto settings of inclined retorts have been arranged to allow the gas as produced to rise into the free space above the coal, pass out through the lower end of the retort, and thence, by way of the ascension-pipes, into the hydraulic main. In flowing through the entire length of the retort and remaining in contact with its highly heated surfaces, the gas is decomposed, with the resulting formation of thick tar and carbon, and the consequent deterioration in the quantity and quality of the gas. MM. Michel de Brouwer and Charles Meitzler have devised an arrangement by which, as they claim, this defect is obviated; and they have taken out a patent for it for France [No. 470,359 of 1914]. It consists of superinclined retorts so set that they can be completely filled with coal. The gas will pass through the charge towards the top end of the retort, and then into the ascension-pipes. The producer for heating the retorts is situated under the upper part, and contains sufficient fuel for half-a-day's working; the result being that no attendance is required for the furnaces during the night. Regeneration is continuous, so that the secondary air for each nostril is regularly heated by passing through the same length of flues.

In the accompanying illustrations, fig. 1 is a transverse vertical section of a retort on the line X of fig. 2, which is a longitudinal vertical section through the line Y of fig. 1; fig. 3 being a similar section through the line *Z*.

The retorts A are cone-shaped, to facilitate drawing. The gas passes through the coal B towards the upper end of the retort, rises into the hydraulic main, and flows thence to the other parts of the plant. When the coal has been well carbonized, the lower end of the retort is opened, and, owing to its angle of inclination and conical shape, the contents fall out.

The retorts are heated by the gas from a producer C. It is burnt at nostrils by secondary air, which is well heated in passing through the flues E and F of regenerators placed on either side of the producer. The secondary air ascends through them in a zigzag course as far as the exit G, shown by the broken lines in fig. 3, whereas the vapours descend in the flues H and I in a similar course, as shown by the unbroken lines, and pass into the chimney. Thus the secondary air for each nostril will travel the same distance and under like conditions; the result being that the chimney draught will be very regular, and the retorts heated to the same degree in all parts.

The advantages claimed for the arrangement described may be briefly specified as follows: (1) Larger charges in the retorts without increase of length; (2) greater production of a setting; (3) increased yield of gas; (4) economy of fuel, because all the heated surface of the retorts is in direct contact with the coal; and (5) considerable reduction of labour.

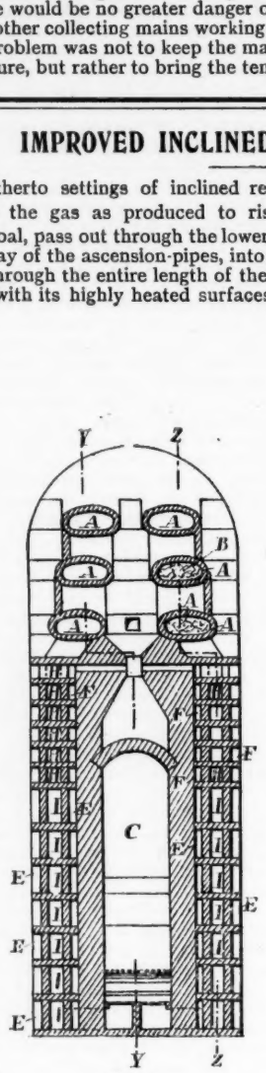


Fig. 1.

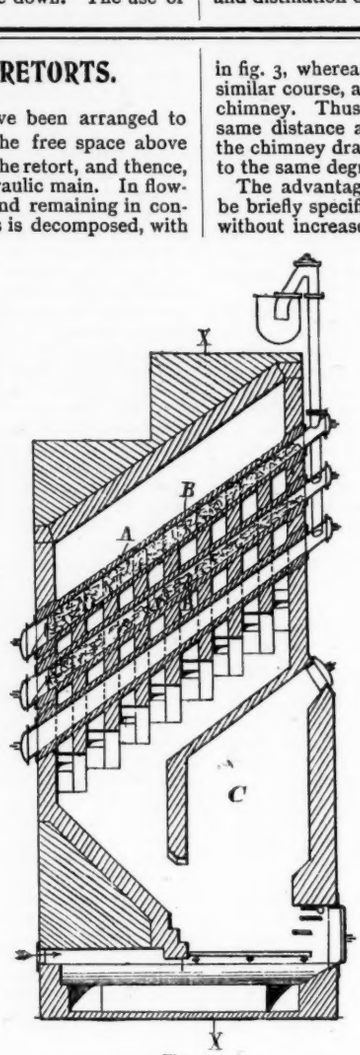


Fig. 2.

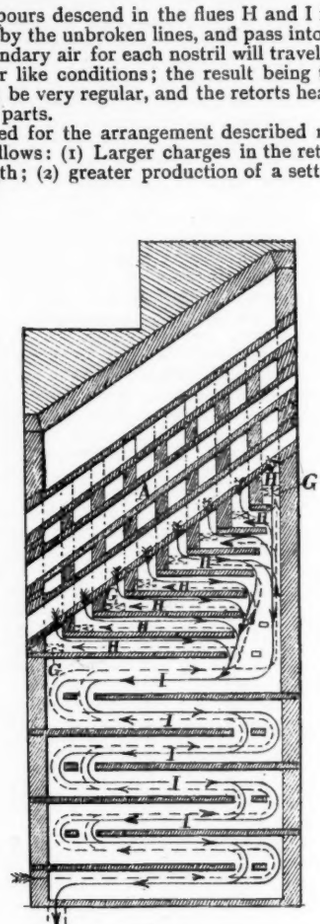


Fig. 3.

Increase in Thorium and Mantle Prices in Germany.—The "Journal für Gasbeleuchtung" for the 10th inst. reports that, in consequence of the scarcity and dearness of the raw materials for the preparation of thorium nitrate, the price of thorium in Germany has been raised by a further 40 per cent., which, with the rise that took place last year, is a total rise in price of 80 per cent. As a consequence, at a recent meeting of the Associated German Mantle Manufacturers with representatives of independent mantle manufacturers, it was decided to advance the price of mantles in Germany to the extent of 5 pf. (½d.) apiece.

Gas Supply in Germany.—The statistics of gas production in 621 works in Germany during the month of December last have just been published by the Berlin Central Gas Publicity Bureau. They show that the total gas production was 9·3 per cent. less than in December, 1913. The corresponding percentage decreases for August, September, October, and November last were 4·4, 10·7, 11·1, and 9·2 respectively. The statistics as to the number of gas-meters in use by German gas undertakings in December have not been published. The Central Bureau explains that, owing to the great claims on the time of the reduced office staffs, the figures furnished show so many omissions that the Bureau does not consider that any data based on them would be representative of the state of affairs in the country generally.

THE PRODUCTS OF COAL DISTILLATION.

By W. J. A. Butterfield, M.A., F.I.C., Assoc.Inst.C.E.

[An Address delivered at the Cardiff Conference on the Extension of British Trade, April 20.]

The great European War which is now raging has demonstrated, incidentally, the dependence of one country on another for many staple products, and in particular has brought home to us in the United Kingdom the large extent to which we had become dependent on Germany for many manufactured goods and materials. Now that we are perforce obliged either to obtain these goods from allied or neutral countries, or to undertake their manufacture in the United Kingdom, much attention has been drawn to the economical considerations which have determined hitherto the establishment or location of the manufactures in question in Germany. In many cases, as, for instance, the glass and other industries, in which potash is an essential raw material, it is quite obvious that Germany, having something approaching a monopoly of the natural supplies of potash salts, would be in an advantageous position to manufacture for the world. But in many other cases, it is not at once apparent that Germany has had any great natural advantage to facilitate her attainment of the predominant position in a particular industry. A case in point, which is germane to the subject of this lecture, is the approach to a monopoly which Germany has obtained in the coal-tar colour industry. In other branches of industry dependent on the utilization of the products of distillation of coal, Germany also has taken a leading position. It will be useful at the outset to consider whether there are any fundamental reasons why the United Kingdom should not become independent of foreign supplies for nearly the whole of the manufactures which are obtained directly or indirectly from the crude products of the distillation of coal.

Coal Supplies.

In respect of coal supplies, the United Kingdom and Germany are on a fairly equal footing. The output of coal in the United Kingdom in the year 1913 was 287,430,473 tons; the output of similar coal in Germany in that year was about 188,485,000 tons. In addition to this, however, Germany raised in the same year 86,093,000 tons of brown coal or lignite, which, though a poorer fuel than bituminous coal, makes very serviceable briquettes, and is also used for the production of oil somewhat resembling the shale oil of Scotland. The total output of coal and brown coal in Germany in 1913 was, therefore, 274,578,000 tons—a figure which is very little short of the output of coal in the United Kingdom in the same year. The export of coal from Great Britain is, however, on a larger scale; and the quantity retained for home consumption in the year 1913 amounted to 189,092.369 tons. Germany retained about 155.503,000 tons of coal, and 93,455,000 tons of brown coal (some being imported); making a total of 248,958,000 tons of coal and brown coal available for consumption in the German Empire. The total quantity of coal and brown coal consumed in Germany is therefore greater than the consumption of coal in the United Kingdom; but it must be remembered in this connection that, whereas the population of the United Kingdom in 1913 was estimated at 46,032,115, the population of Germany in the same year was about 67,234,000. These figures show a mean consumption of coal of 4·108 tons per head in the United Kingdom, and 3·68 tons of coal and brown coal per head in Germany.

It is not unreasonable to take the consumption of coal as a measure of the relative industrial activity of the two countries, since neither of them utilizes water power to any great extent, and neither of them has any large home supply of oil. Difference of climatic conditions is not so great as to cause a much larger consumption of coal for heating dwelling-houses and buildings in one country than in the other, because greater winter cold in Germany is balanced by greater humidity here. The importation of oil as a fuel is certainly greater in the United Kingdom than in Germany, but may for the present purpose be left out of account, and the relative industrial activity of the two countries be based purely on the coal consumption. It is therefore gratifying to note that the consumption of coal per head of the population is greater in the United Kingdom than in Germany. It may, of course, be argued that this greater consumption merely implies greater waste; and such a suggestion is difficult to refute from statistics. But those who know the industrial districts of Westphalia and the Rhine can testify to the fact that the smoke abatement movement has not made as much progress in German factories as it has here. Economy in the use of fuel for heating dwelling-rooms in Germany is probably more apparent than real—a point to which reference will be made later.

Quantities of Coal Carbonized.

It is in respect of the quantities of coal carbonized or distilled in the manufacture of gas and coke that we are now more particularly concerned. It is estimated that in the year 1913 37,483,944 tons of coal were used in the manufacture of gas and coke in the United Kingdom. Of this total, something over 16,000,000 tons was carbonized in gas-works, and the remainder in coke-ovens. The coke produced in ovens in the United Kingdom in the year 1913 was 12,798,996 tons, in the production of which about 21,331,660 tons of coal must have been used. The coke produced in ovens in Germany in 1913 amounted to about 32,168,000 tons, in the production of which about 53,613,000 tons of coal must have been used. The coal consumed in gas making in Germany in 1913, on the basis of the gas produced, must have been about 9,000,000 tons. It will be seen from these figures that, while the coal carbonized in the United Kingdom amounts to 37,483,944 tons, the coal carbonized in Germany amounts to about 62,613,000 tons. There is, however, a difference of considerable importance so far as the utilization of products is concerned, that whereas in the United Kingdom 42·7 per cent. of the total coal carbonized is carbonized on gas-works, in Germany the corresponding figure is 14·4 per cent. The total quantities of coal carbonized, and their apportionment between gas-works and coke-ovens, must be constantly borne in mind in any discussion of the methods of utilization of the products in the two countries.

It will be obvious from the foregoing data that since Germany carbonizes more coal than the United Kingdom she produces a larger quantity of the products which serve as the raw material for the colour and many other chemical industries. Further, owing to the larger proportion of coal carbonized in ovens in Germany, the quantity of some crude products which are of primary importance in chemical industries—such as benzol, which is recovered only to a very small extent on gas-works—is very much greater in Germany, relatively to the total amount of coal carbonized, than in the United Kingdom. Hence, as regards any chemical industries for which benzol and tar are raw materials, Germany has now the advantage at the outset of a much more abundant home supply. This advantage depends primarily on the greater development in Germany in recent years of the iron industry, which consumes the present enormous production of oven coke in this country. Whether it is possible in the near future to bring the home supplies of tar and benzol in the United Kingdom equal to those of Germany in recent years must depend very much on whether we can obtain a sufficient supply of good grade iron ore at a price which, having regard to the cost of coal and coke in this country, will enable us to produce pig iron and steel as cheaply as these products have been produced of late in Germany, Belgium, and the United States.

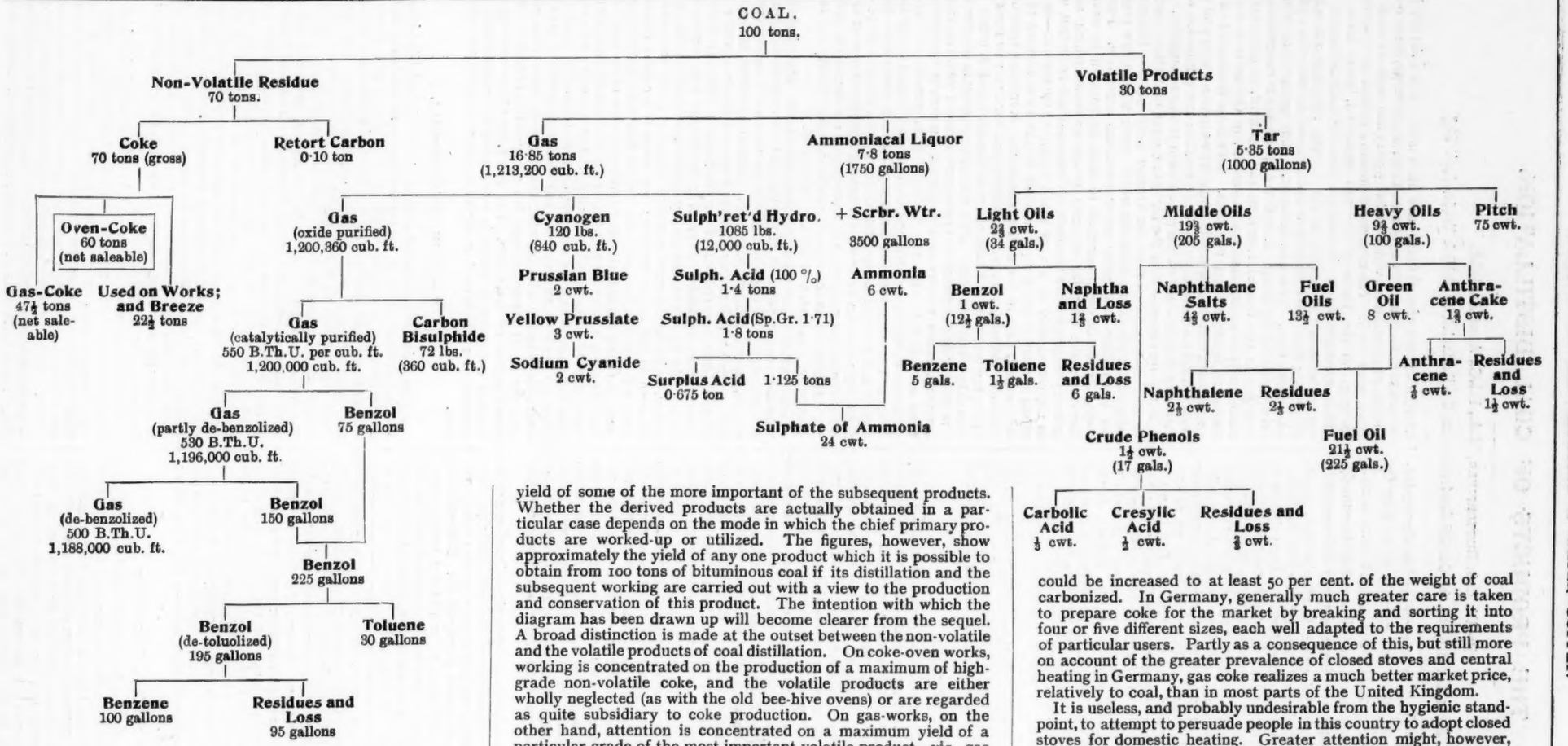
This is a problem which at first sight seems somewhat far removed from the question of the products of coal distillation; but it really involves the chief factor by which the home supplies of tar, benzol, &c., are governed. As matters stood immediately before the war, Germany had the immense advantage of a more plentiful home production of tar and benzol. Actually the quantity of these products produced in the United Kingdom is lower in relation to the total quantity of coal carbonized than in Germany, owing to the more extensive adoption of the recovery type of oven in the latter country; but even if recovery ovens had been universally adopted in the United Kingdom, Germany would nevertheless have had a larger home production of tar and benzol. Incidentally, it may be pointed out that Germany's coke-ovens have proved of invaluable service to her since the outbreak of war, for, though coke is now required in relatively small quantities by her iron and steel industries, her coke-ovens have been kept at nearly full work in order to provide supplies of tar oils for fuel for naval purposes, and benzol and tar products for the manufacture of explosives. For the time being coke has become a bye-product, which is being used for railway and other purposes for which coal or briquettes were hitherto the ordinary fuel.

South Wales Conditions.

As regards the particular district of the United Kingdom with which this conference is concerned, the coke produced at coke-ovens in 1912 in the counties of Glamorgan and Monmouth (together with Denbigh, the production of which is, in the available statistics, included with that of Glamorgan) amounted to 1,227,863 tons, which is equivalent to a consumption of 2,046,439 tons of coal in coke making. The coke production in ovens in the three counties is about 11·5 per cent. of the total coke production in ovens in the United Kingdom. The coal carbonized in gas making in 1912 in the same three counties was 350,462 tons, which is only 2·2 per cent. of the total quantity of coal carbonized in that year in the gas-works of the United Kingdom. Thus, while the consumption of coal in gas-works in the district is low per head of the population in comparison with the greater part of the United Kingdom, the consumption of coal in coke-ovens is relatively high, and the three counties actually carbonize in gas-works and ovens about 7 per cent. of the total coal carbonized in the United Kingdom.

These figures are a measure of the total available local production (assuming that recovery ovens were general) of benzol and tar products; but, owing to the extensive sea board of the district, supplies of these raw materials may be readily imported from other parts of the United Kingdom for use in local chemical works. In the patent-fuel industry, the district already draws large supplies of pitch from other districts of the United Kingdom. Thus the district with the great advantages of cheap fuel and

PRODUCTS FROM THE DISTILLATION OF 100 TONS OF BITUMINOUS COAL. Approximate Average Yields.



good ports is as well situated as any in the United Kingdom for the establishment of chemical industries which utilize the products of coal distillation as raw materials.

RELATIVE PROPORTIONS OF PRODUCTS OF COAL DISTILLATION.

The proportions in which the products of the distillation of coal in ovens and on gas-works occur, vary with the description of coal and the type of carbonizing plant; but some representative average figures are given in the above diagram. This diagram shows the approximate yield of the primary products of distillation, the return of secondary products from them, and the ultimate yield of some of the more important of the subsequent products. Whether the derived products are actually obtained in a particular case depends on the mode in which the chief primary products are worked-up or utilized. The figures, however, show approximately the yield of any one product which it is possible to obtain from 100 tons of bituminous coal if its distillation and the subsequent working are carried out with a view to the production and conservation of this product. The intention with which the diagram has been drawn up will become clearer from the sequel. A broad distinction is made at the outset between the non-volatile and the volatile products of coal distillation. On coke-oven works, working is concentrated on the production of a maximum of high-grade non-volatile coke, and the volatile products are either wholly neglected (as with the old bee-hive ovens) or are regarded as quite subsidiary to coke production. On gas-works, on the other hand, attention is concentrated on a maximum yield of a particular grade of the most important volatile product—viz., gas—and the other volatile products and coke become quite subsidiary to the gas.

COKE.

The gross yield of coke is approximately 70 per cent. of the coal carbonized; but the use of coke as the sole fuel for heating the retorts on gas-works, and the production of small breeze which has very little, if any, market value, reduces the saleable coke to 47·5 per cent. of the weight of coal carbonized on gas-works throughout the United Kingdom. It is likely that, by the adoption of more economical retort-settings and greater care in the handling and screening of coke, the proportion available for sale could be increased to at least 50 per cent. of the weight of coal carbonized. In Germany, generally much greater care is taken to prepare coke for the market by breaking and sorting it into four or five different sizes, each well adapted to the requirements of particular users. Partly as a consequence of this, but still more on account of the greater prevalence of closed stoves and central heating in Germany, gas coke realizes a much better market price, relatively to coal, than in most parts of the United Kingdom.

It is useless, and probably undesirable from the hygienic standpoint, to attempt to persuade people in this country to adopt closed stoves for domestic heating. Greater attention might, however, in many cases be given to the preparation of coke to suit particular types of furnaces and kilns. Much of the prejudice against the use of coke in this country is undoubtedly due to inadequate screening and sorting, and to the coke being over-wet through carelessness in quenching or in storing. The wetness is most marked when the breeze has not been screened from the coke; and for domestic use the breeze is wholly objectionable. Coke-breeze itself, however, can be used successfully as an economical furnace fuel with specially designed grates, and is already thus used on many works in this country. But efforts should be made to extend the adoption of breeze grates.

Coke-breeze is also worked-up to egg-shaped or other small

briquettes in some works, both here and in Germany, though in Germany brown coal is preferred as a raw material for briquette making. There appears to be scope for the extension of the manufacture of coke-breeze briquettes in the country, though probably only in districts that are more remote from coalfields than South Wales. A briquette-making plant specially adapted for coke-breeze has been described quite recently in the German Technical Press.*

The yield of coke available for sale is greater from coke-ovens than on gas-works, and in round figures may be taken at 60 per cent. of the weight of coal carbonized.

Retort carbon or scurf occasionally has a fairly high market value; but in the smaller gas-works of the country the quantity obtained is so small that it is scarcely worth marketing. The net yield per 100 tons of coal carbonized varies greatly, according to the types of retort, heats of carbonization, description of coal, and the method of scurfing employed, and is often less than 0·10 ton, as given in the diagram.

Volatile Products.

The hot gas liberated from the carbonization of bituminous coal deposits condensable matter from the time it leaves the retort or oven and is subjected to cooling influences. The matter condensed in the cooling of crude coal gas consists of hydrocarbon compounds mixed with an aqueous solution of ammoniacal salts and with particles of soot or carbonaceous dust. The hydrocarbon compounds and carbon particles, when separated from the aqueous ammoniacal liquor, constitute the complex bituminous mixture known as coal tar. The crude gas from which tar and a considerable proportion of the ammonia compounds have been removed by cooling and screening, still contains: (*a*) A considerable quantity of ammonia compounds, (*b*) a smaller quantity of cyanogen compounds, (*c*) a considerable quantity of sulphur compounds, and (*d*) highly volatile hydrocarbons approximately in the quantities corresponding with the vapour tension of these hydrocarbons at the temperature to which the gas has been cooled. These compounds will be referred to in turn.

(*a*) In gas-works practice the ammonia compounds in the cold gas are removed by washing or scrubbing, first with the condensed liquor, and subsequently with clean water; and the condensed liquor and the water used in washing together form the ammoniacal liquor, which will be referred to later on under the heading of "Ammonia Production." In coke-oven practice the ammonia compounds are often recovered by direct absorption in sulphuric acid.

(*b*) The cyanogen compounds are partially abstracted with the ammonia compounds in the cooling and washing of the gas, and a further portion is abstracted with the sulphur compounds for the removal of which the gas, in gas-works practice, is subsequently passed through purifiers charged with lime or oxide of iron. The oxide of iron purifiers, however, do not remove the whole of the cyanogen compounds, and their recovery from the purifying material is not a very simple matter. Consequently, special processes are applied in many of the larger gas-works, especially in Germany, for the direct extraction of the cyanogen compounds from the crude gas. These processes will be referred to under the heading of "Cyanide Production."

(*c*) The sulphur compounds in crude coal gas are partially abstracted with the ammonia in the condensation and washing processes; but a considerable amount—varying with the quantity and state of combination of the sulphur in the coal carbonized—remain in the washed gas. The problem of purification, with gas intended for general consumption, is to remove the whole of the sulphuretted hydrogen and more or less of the carbon bisulphide. The recovery of the sulphur by purification will be dealt with under the heading "Sulphur Recovery."

(*d*) The chief highly volatile hydrocarbons which remain in coal gas after cooling or condensation are benzene, toluene, and naphthalene. They are associated with smaller quantities of the higher hydrocarbons of the same series, and with small quantities of condensable paraffins and olefines.

In coke-oven practice the proportion of naphthalene is relatively small, and the volatile hydrocarbons are, in recovery ovens, extracted by washing the gas with an oil which has a high solvent capacity for them, or by some equivalent procedure. The recovered hydrocarbons constitute crude benzol, of which from 150 to 400 gallons are obtained per 100 tons of coal carbonized. In gas-works practice oil-washing has been applied in a few works in the United Kingdom, and in many works in Germany, for the complete abstraction of naphthalene from the gas; and quite recently the process has been much extended, under Government auspices, to other gas-works in this country, in order to recover the toluene, which at the present time is much needed as the raw material for the manufacture of the explosive, trinitrotoluene, or T.N.T. The extraction of volatile hydrocarbons from gas, and the commercial possibilities, attaching to it in peace as well as war time, will be referred to under the heading "Benzol Recovery."

Ammonia Production.

The ammonia in crude coal gas is associated with acid radicles. The liquor obtained by condensation of the water vapour from the hot gas contains it, combined chiefly as carbonate and sulphide. The volume of such liquor varies chiefly with the amount of water in the coal carbonized, and may average perhaps 1750 gallons per 100 tons of coal. But, in addition to this condensed or "virgin" liquor, more or less water is used in gas-works practice to effect the complete extraction of the ammonia from the gas, and the total volume of gas liquor obtained is considerably greater—generally from 2500 to 4000 gallons per 100 tons of coal. This liquor contains on the average about 6 cwt. of ammonia, which yields 24 cwt. of sulphate of ammonia of high grade—*i.e.*, containing 25 per cent. of ammonia.

Statistics as to the output of sulphate are being furnished by Mr. R. H. Greaves; and here it is only necessary to emphasize the fact that German manufacturers now commonly produce sulphate guaranteed to contain not less than 25 per cent. of ammonia, not more than 3 per cent. of moisture, and not more than 0·5 per cent. of free acid. It is eminently desirable that the sulphate exported from the United Kingdom should be of as high a grade as this. The chief conditions to be observed in order to attain this grade are that the specific gravity of the liquid in the saturator should be kept as nearly as possible at 1·29, and that the salt should be thoroughly drained and dried, preferably by a centrifugal machine. Sulphate of lower grade entails higher freight for a given nitrogen content, loss of salt by adhesion to the bags, rotting of the bags by the free acid, and risk of injury to vegetation by excess of free acid. For effective competition with Germany the grade indicated must be produced.

Cyanide Production.

The cyanogen compounds in crude coal gas are generally and conveniently regarded as chiefly present in the form of ammonium cyanide. In gas-works practice the quantity contained in crude coal gas ranges from 0·05 to 0·20 per cent. by volume of hydrogen cyanide (prussic acid), or 50 to 200 grains of cyanogen per 1000 cubic feet of gas. The proportion varies with the nitrogen content of the coal; but with a coal of given nitrogen content the formation of cyanogen is favoured by high heats of carbonization and absence of water vapour. The excess of water vapour in the hot gas which results from the carbonization of moist coal hinders the formation or preservation of cyanogen; and consequently gas from coke-ovens generally contains much less cyanogen than that from gas-retorts.

Germany produces more cyanides than the United Kingdom; but she possesses in beet molasses residues a large quantity of a raw material for cyanide production which is not available in this country. She also produces some cyanides from atmospheric nitrogen. Statistics do not appear to exist as to her output of cyanides from different sources, or even her total output. We know, however, that in 1912 Germany exported 6451 tons of potassium and sodium cyanides, valued at £420,600, and 1148 tons of yellow and red prussiates and sodium ferro-cyanide, of a value of £49,850, and that her exports for some years previously had been on practically the same scale, and her imports negligible. She also exported in the same year 2556 tons of prussian blue and allied colouring matters, valued at £111,810. It is probable that German gas-works alone have yielded in recent years from special washing processes and from the working-up of spent purifying material (having oxide of iron as the chief active constituent) cyanogen products equivalent to over 10,000 tons of yellow prussiate per annum. Probably the output of gas-works in the United Kingdom has not exceeded 5000 tons per annum. Were cyanogen extraction extended to all the gas-works, there would be a production of about 24,000 tons of yellow prussiate, or the equivalent of other cyanogen products.

The average yield of cyanides from coal gas in this country should be about 2 cwt. of prussian blue, or 3 cwt. of yellow prussiate, or 2 cwt. of sodium cyanide per 100 tons of coal carbonized. For the production of prussian blue by the ferrous sulphate washing process about 102 lbs. of iron are theoretically required per 2 cwt. of prussian blue produced; but in practice about 6 cwt. of commercial ferrous sulphate crystals, representing about 127 lbs. of iron, are used up.

It is noteworthy that practically all the successful processes for the direct recovery of cyanides from coal gas have been worked out first in the United Kingdom. The Beckton works of the Gas Light and Coke Company employed the ferrous sulphate washing process on a large scale in 1892—some years before Bueb, of Dessau, in ignorance of the Beckton work, worked it out independently and obtained a German patent for it. The Foulis process originated at the Glasgow Gas-Works; the British Cyanides process, and Mr. P. E. Williams's modification of it, were devised and perfected at gas-works in the London district. It seems probable that cyanogen extraction might be extended with profit in gas-works in this country, and a large proportion of the German export trade in cyanides captured. But there is no margin for extravagence in working expenses. Cyanogen extraction may, however, indirectly effect a considerable saving to gas-works, since the cyanides in gas are largely responsible for the corrosion of steel work, especially gasholder sheeting. The works where it is most likely to prove remunerative are those in which the driest coal is carbonized in shallow charges at high heats. It is unlikely to prove remunerative at coke-ovens, where the reverse conditions prevail, and where tar extraction is less perfectly effected.

Sulphur Recovery.

The chief sulphur compound—viz., sulphuretted hydrogen—will occur to the extent of about 1 per cent. by volume in the gas produced from average English coal, together with about 0·03

* The experiment here referred to forms the subject of an article appearing on p. 212.

per cent. by volume of carbon bisulphide vapour. These figures correspond with 12,000 cubic feet, or approximately half-a-ton of sulphuretted hydrogen, and 360 cubic feet, or 72 lbs. of carbon bisulphide, per 100 tons of coal carbonized. The sulphuretted hydrogen is generally retained in purifiers by the use of oxide of iron, in which the sulphur ultimately becomes deposited in the free state. When the oxide has become fully loaded with sulphur or "spent," the sulphur in it is converted to sulphuric acid by combustion in burners similar to those used in sulphuric acid manufacture from pyrites. The half ton of sulphuretted hydrogen removed in the oxide purifiers per 100 tons of coal carbonized corresponds with a production of 1·4 tons of real sulphuric acid, or 1·8 tons of sulphuric acid of 1·71 specific gravity, such as is generally used in the manufacture of sulphate of ammonia.

Since the ammonia from 100 tons of coal averages a quantity which requires about 1·125 tons of sulphuric acid of 1·71 specific gravity for its neutralization, it is obvious that crude coal gas, as produced from most English coal, can yield more than enough sulphuric acid for the production of sulphate from the whole of the ammonia present. The intervention of the oxide of iron and the sulphur burners and acid plant is, however, a very indirect method for effecting the combination of the ammonia and sulphur to form sulphate of ammonia; and a problem which has exercised many inventors is that of the oxidation of the sulphur and its combination with the ammonia by a single process. Various schemes have been tried on a working scale; but up to the present no one of them has been clearly demonstrated to be economically successful. There is, however, no question but that this problem will be solved in the near future; and as its solution should be available not only in gas-works, but in coke-oven practice, it is a problem that well deserves immediate and large expenditure on laboratory research and large-scale trials. There is yet time in this matter for the problem to be successfully solved in this country before it is solved elsewhere.

The carbon bisulphide is removed from gas only in cases where special importance is attached to a high degree of purity of the gas distributed for town supplies. Its removal can be effected, at relatively small cost, by the elegant process elaborated by Mr. E. V. Evans, under the auspices of Mr. Charles Carpenter, at the works of the South Metropolitan Gas Company. The successful issue which in this case has attended many years' research work and large-scale trials, proves that, when given the opportunity, the technical chemists and works engineers of this country are capable of as great achievements as any of their Continental rivals.

Benzol Recovery.

Benzol recovery from the gas obtained from both coke-ovens and gas-retorts is for the time being a matter of national importance, since toluene, which forms from 10 to 25 per cent. of the benzol, is imperatively required in as large quantities as possible for the manufacture of trinitrotoluene, which, by itself, is one of the safest and most powerful of explosives for bursting charges, and is an important constituent of "ammonal," which is an even more powerful explosive than pure trinitrotoluene. Consequently, benzol-recovery plant is being employed on the larger gas-works of the United Kingdom. But whereas in recovery oven practice the gas is stripped of the whole of its benzol content, on the gas-works only the toluene content of the benzol is removed permanently from the gas.

In May, 1913, the author supported Mr. H. L. Doherty, of New York, in his advocacy of the complete or partial extraction of benzol from town gas supplies, believing that the extracted benzol would be of more service to the community for use as motor spirit than the benzol vapours, when retained in the gas, were to gas consumers. The plant for the extraction of toluene now being employed on many gas-works may be utilized to test the practicability of this proposal, and with some modification of its working may continue to be of service after peace has been declared. Broadly speaking, coal gas contains about 1 per cent. by volume of vapour of benzene, toluene, &c.; and if the whole of this is extracted, there are obtained about 2·25 gallons of crude benzol per ton of coal carbonized. In practice, the figure ranges from 1·5 to 3 gallons, varying with the class of coal carbonized, and the temperature and form of the retorts.

The removal of all the benzol from coal gas should effect a reduction of only about 7 per cent. in the calorific power of the gas. The debenzolized gas would give practically no light with open-flame burners, though the light from incandescent burners would be affected only to a small extent. The trend of recent legislation in regard to town gas supplies is to require that the gas shall have a gross calorific power of not less than 500 B.Th.U. per cubic foot; and no other requirement is made in respect of its value for lighting purposes. It has been ascertained by practical trial that at least one-third of the benzol content of coal gas, as produced on gas-works at the present day, can be abstracted from the gas without reducing its calorific power below the standard of 500 B.Th.U. per cubic foot. Gas from which one-third of its benzol content has thus been removed gives as much light with open-flame burners as is required for the uses for which they are still retained. Hence if there is a sufficiently good market for the extracted benzol, it would appear to be economically politic that one-third of the benzol content of coal gas produced on gas-works should be extracted from it before its distribution to consumers. Since the quantity of coal carbonized on gas-works in the United Kingdom in 1912 amounted to 16,052,487 tons, if we make the reasonable assumption that the gas contains on the average benzol equal to 2·25 gallons per ton of coal, the extraction of one-third of this benzol would give a yield of 12 million gallons of benzol per annum from the whole of the gas-works of the United Kingdom. This quantity of benzol, though small relatively to the total obtainable if the whole of the gas produced from coke-ovens were completely debenzolized, would nevertheless be a valuable addition to the home production of benzol.

Regarding benzol not merely as a raw material for chemical manufacture, but as a motor spirit of somewhat higher power than imported petrol, it appears desirable in the national interest that the home supply of benzol should be increased to the largest possible extent. The possible supply from coke-ovens, if the whole of the gas produced in them were debenzolized in recovery plant, would amount, on the basis of the output of coke in the United Kingdom in 1913, to about 60 million gallons. This is independent of the comparatively small quantities of benzol obtained from the distillation of coal tar, which will be referred to later. The coal tar supply, however, goes far towards meeting the present demand for benzol for chemical manufactures in this country; and the greater part of the possible output of benzol, from the complete stripping of coke-oven gas and partial stripping of town gas, might be regarded for the time being as available for motor spirit in competition with imported petrol. The consumption of petrol in the United Kingdom prior to the outbreak of war was at the rate of about 130 million gallons a year, and rapidly increasing.

Germany, with her larger coke production, and her more general use of recovery ovens, already has a very much greater output of benzol than the United Kingdom. Notwithstanding her large consumption of benzol in chemical manufactures, she was able to show exports (after deducting imports) of benzol, toluol, &c., of 24,712 tons, or 6,301,560 gallons, in 1912, and 34,032 tons, or 8,678,160 gallons, in 1913. So far as these exports related to the lower grades of benzol, and not to pure benzene, toluene, &c., it seems that it would be of little service to this country to attempt to capture the German export trade in benzol, unless motor spirit of the petrol type can be imported at lower prices than those at present prevailing. But the production of benzol on as large a scale as possible certainly seems desirable in order to check any further increase in the price of petrol.

Toluene occurs in crude benzol to the extent of 10 to 25 per cent. Perhaps an average yield of 12·5 per cent. of pure toluene may be generally anticipated. There is no doubt that for some years past immense quantities of toluene have been converted in Germany into trinitrotoluene, and that great stores of this valuable explosive had been thus accumulated in the country prior to the outbreak of war. For one or two years immediately preceding the war, the export of trinitrotoluene from Germany to this country appears to have been hindered, ostensibly on account of the difficulty of shipping dangerous goods. Seeing, however, that, in the absence of a powerful detonator, trinitrotoluene is an absolutely safe material, and that other goods of a really dangerous character from the carrier's standpoint were freely exported to this country, it would appear that Germany was more provident than Great Britain in the matter of producing and retaining large stocks of war material. Is it possible that foreknowledge of impending events guided her in this matter? Trinitrotoluene will continue in demand after the war is over, as it is a constituent of one of the most powerful blasting explosives, and is also used in the production of instantaneous fuses which are unaffected by water.

The complete removal of naphthalene from coal gas is carried out in many gas-works, not on account of the value of the naphthalene recovered, but because gas from which the naphthalene has not been almost entirely removed is apt to leave a highly voluminous deposit of solid naphthalene in mains and service pipes, thereby obstructing, and even wholly blocking them. Coke-oven gas is relatively free from naphthalene. The procedure of oil-washing commonly followed for the recovery of benzol from gas likewise abstracts the naphthalene. By far the larger proportion of the naphthalene produced in the carbonization of coal is contained in the coal tar; and the utilization of naphthalene will be referred to in that connection.

Coal Tar.

Perhaps coal tar is, from the chemical manufacturer's standpoint, the most interesting raw material in the world. The yield and composition of the tar obtained in the distillation of bituminous coal varies considerably according to the description of coal and the type and temperature of the carbonizing plant. But broadly, at the present time in this country, it may be stated that the yield of tar, freed from water, is about 1000 gallons per 100 tons of coal; and as its specific gravity is about 1·2, the yield by weight is therefore about 5·35 per cent. of the coal carbonized. For the production of materials for chemical manufacture and for many other purposes coal tar is distilled; and the primary products, with the yields per 100 tons of coal carbonized, may be stated as follows: (*a*) Light oils, of which the yield averages 34 gallons, or (say) 2¾ cwt.; (*b*) middle oils, of which the yield averages about 205 gallons, or (say) 19¾ cwt.; (*c*) heavy oils, of which the yield averages about 100 gallons, or (say) 9¾ cwt.; and (*d*) pitch, of which the yield averages about 75 cwt.

Crude tar is frequently used for tar painting, whether of wood, metal work, road surfaces, or masonry. But it may be said that for all such purposes it is distinctly inferior to a partially distilled tar—*i.e.*, one from which the light oils and the accompanying ammoniacal liquor have been completely removed by distillation.

Seeing that the light oils yield benzene, toluene, xylene, and solvent naphtha, all of which are in great demand for chemical industries or in only a partially refined state for motor fuel, it is highly desirable that they should in all cases be extracted from tar before its use for any purpose. The removal of the light oils from coal tar may be readily effected by the simple coil type of tar-dehydrating plant, and such plant is all that is required when it is not proposed to carry the distillation of the tar any further. This type of plant is also useful for removing the water from coal tar preparatory to its introduction into the ordinary tar stills for further distillation.

Refined, or dehydrated, tar, as prepared by such plant, has now a very extensive application in this country for the tar painting of road surfaces; and provided certain conditions of application are observed, it has the effect of greatly extending the durability of the road surface, as well as incidentally preventing the formation of dust. In the application of tar as a road-surfacing material, this country is at the present time far ahead of all others, partly because of the wide distribution of the large home production of coal tar, and partly because our temperate climate is less destructive of the tar coating than any other. In Germany, comparatively little tar-painting of roads is carried out.

(*a*) *Light Oils.*—The light oils, on distillation and refining of the products, yield about one-third of their volume of the commercial grades of benzol known as "90's." and "50's.;" the residue being various grades of naphtha. Further working-up of the benzol will give a yield of about 5 gallons of pure benzene and 1·5 gallons of pure toluene per 100 tons of coal carbonized. It will be seen, therefore, that the yield of benzene and toluene obtained from the coal tar is trifling compared with that obtainable by applying benzol recovery to the gas. In the case of many tars appreciably higher yields are, however, obtainable. Benzene, toluene, and xylene, which are obtained from the heavier fractions of benzol and the lighter fractions of naphtha, are the raw materials from which many nitro compounds are produced for the manufacture of explosives, and for the preparation of bases such as aniline, toluidine, xylidine, &c., which are the starting points for the manufacture of large classes of dye-stuffs and drugs. The more important explosives produced from the products of the light oils are trinitrotoluene, already referred to, and tetranitroaniline. Congo red, indigo, the large number of aniline dye derivatives, fuchsine, and eosine, are among the most important derivatives of the benzene hydrocarbons. The manufacture of the nitro compounds and aniline, &c., is carried out on a fairly large scale in this country; but the production of actual dye-stuffs is only on a comparatively small scale—viz., about one-tenth of the requirements of the country.

(*b*) *Middle Oils.*—The phenols and naphthalene are the chief constituents of the middle oils which are of value in chemical industry. The residual oil from which these products have been extracted more or less completely is used for such purposes as preserving timber, and as oil fuel. The phenols are worked-up into disinfectants, and phenol itself is the raw material for the manufacture of salicylic acid, many dye-stuffs, and the important modern explosive trinitrophenol or picric acid. Naphthalene is likewise used in the manufacture of a large series of dye-stuffs. Germany's imports and exports of naphthalene about balance.

(*c*) *Heavy Oils.*—The heavy oils contain anthracene, from which anthraquinone, and thence the large series of alizarine dye-stuffs, are produced. The residual heavy oils, after the extraction of the anthracene, are used as fuel oils and for the softening of pitch for various purposes. After deduction of imports, Germany's net exports of tar oils, other than benzols, amounted to 120,895 tons in 1912 and 124,220 tons in 1913. She imports more anthracene than she exports.

(*d*) *Pitch.*—Coal-tar pitch, prepared of varying degrees of hardness by the retention in it of more or less heavy tar oil, finds its chief application in the patent fuel industry. Very large quantities, however, are now being used in the construction of roads, and in smaller quantities pitch is used as an insulating material. Germany's excess of exports over imports of pitch was 30,730 tons in 1912, and 37,433 tons in 1913.

The Synthetic Colour and Drug Industries.

The problem of the establishment of the synthetic colour and drug industries in this country on a scale commensurate with the requirements of the country itself, apart from the possibilities of export trade, is one which demands the collaboration of men of the most varied attainments. Success comparable with that attained by the German factories can be achieved only by working on a scale approaching that of these factories; and such large-scale operations obviously cannot be undertaken without the support and guidance of financiers and commercial men of the highest standing and ability. In the author's view, there is no inherent objection to the directorate of an industrial undertaking of this type consisting wholly of financiers and business men. But the control of the working must be delegated by the directorate to an advisory or managing board constituted of technical chemists, with at least one mechanical engineer accustomed to the design and supervision of works plant. Under the Advisory Board there should be head technical chemists, each in charge of one department both of the works and of the research laboratory, which is one of the most important adjuncts of the undertaking. In the research laboratory there will be required, to work under the guidance of the chemists in charge of departments and a few head research chemists, a large number of assistants who need not have had a very exhaustive training in all branches of chemistry, but who must have specialized in certain branches of organic chemistry.

The German colour works employ very large numbers of such assistant chemists, who are content to work year in year out for comparatively low remuneration at the same class of routine research work. But few of them can hope to rise to the higher positions in the laboratory or works; and only a small proportion have either the ability or training which would enable them to fill these adequately. The men of this country who have studied organic chemistry in technical colleges, either here or abroad, for the most part would not be content to spend the greater part of their lives in the routine investigations which constitute the chief part of the work carried out in the research laboratories of the large German colour works. Failing the employment of foreigners, it seems to the author that it would be difficult in this country to obtain a sufficient staff of chemical assistants of adequate training and ability for the research laboratory of a large colour undertaking unless a great number of women students in our universities and technical colleges will devote themselves to preparation for this particular branch of work. It is work which demands great assiduity and patience; and, as a sex, they should be well capable of undertaking it.

The synthetic colour and drug industries appear to offer ample scope for the investment of capital with ultimate prospects of very high returns on the investment; but the initial stages of establishing the industries will be protracted, and large sums will have to be continuously expended in pursuing the laboratory investigations, without which the industries in this country cannot hope to compete with the industries which are already established on so large a scale and so sound a basis in Germany.

CARDIFF TRADE EXTENSION CONFERENCE.

The Coal Bye-Products Industry.

A conference which it is anticipated will have far-reaching results in securing an extension of the coal bye-products industry was held at the Engineers' Institute, Cardiff, on Tuesday last. Mr. J. Stanfield, J.P. (the Chairman of the Technical Schools Committee) presided.

Organized by the Technical Schools Committee and the Development Committee of the City Council, the conference was called to consider the extension of British trade; and it was attended by the leading scientific and commercial men in the city. The probable result will be the appointment of a Committee representative of capitalists, colliery companies, scientists, &c., who will meet to discuss methods by which some of the wastage of bye-products now occurring at the collieries can be avoided. Emphasis was laid on the need of trained chemists for the specialized work, on the success which had attended methods already in existence, and on the enormous wastage of power and products at the present time.

Need for Research.

The proceedings were opened with a paper by Professor H. E. Armstrong, F.R.S., of London, on the "Extension of British Trade," in which the author urged that South Wales should "take stock" of its coal, and secure from it all there was to be obtained.

Mr. T. E. Watson, referring to the remarks of the speaker on the importance of research, said that a very small tax on the output of the coalfield would provide an ample sum for experiments; and there would not be any difficulty, provided the industry were assured of value to be received.

Principal E. H. Griffiths (of University College, Cardiff) regretted there was want of understanding between the scientist and the business man. He found it difficult to get the money necessary for research, and pointed out that there was in Germany a greater readiness to apply what was found in the laboratory to the needs of commercial and industrial life. He proposed a vote of thanks to Professor Armstrong, which was carried.

Dr. G. N. W. Thomas referred to the proposal to establish an aniline dye industry in the district, and said they should endeavour to secure the co-operation of the National Physical Laboratory. If Germany could contribute £70,000 to such work, Britain ought to be able to raise more than the £7000 at present granted.

Coke-Oven Bye-Products.

Mr. T. G. Watts, B.Sc. (of the Great Western Colliery Company), in opening his paper on "Coke-Oven Bye-Products," said gas engineers, through their Associations and weekly periodicals, had already gone far in this matter. There was a grave necessity for trained minds to bring the subject forward, and put it on right lines. Continuing, the author gave a summary of his paper, which was very well received. [An abstract of it appears on p. 211 of to-day's "Journal."]

The Coal Trade and Allied Industries.

Mr. R. H. Greaves, M.Sc. (of University College, Cardiff), in a paper on the "Coal Trade and Allied Industries," showed that the Germans had captured certain markets which might be retaken after the war. There were certain methods of economy that might, and should, be adopted, in order that the fullest value

might be secured from the coal raised. [Further reference to this matter appears on p. 210.]

Products of Coal Distillation.

The Chairman, in introducing Mr. W. J. A. Butterfield, M.A., who gave a paper on the "Products of Coal Distillation," said they had to thank Mr. George Clarry, the General Manager of the Cardiff Gas Company, for having secured the author's aid.

Mr. Butterfield, in touching on the chief points of his paper [which is reproduced on pp. 205-9], remarked that the Germans had a larger quantity of coal carbonized than had Britain; but they had to have regard also to population. Germany still used less coal per head than the United Kingdom; but there was greater economy in the consumption of fuel. All the poorer values were utilized; and he regretted that often in Britain the best coals were used where the inferior sorts would suit equally well. He referred to the manufacture of briquettes from coke-breeze by the addition of 6 per cent. of pitch, adding that this had been successfully done in London. Germany was far behind England in the use of gas for heating purposes, because gas-fires had not been brought to the same pitch of perfection there as they had in England. Unfortunately, South Wales was far behind other parts of the country in its consumption of gas for heating; the average being for the United Kingdom 4750 cubic feet per head, while for Glamorgan and Monmouth it was only 2800 feet. Toluol was badly wanted for the manufacture of explosives, and, before the war, came from Germany. That country had for its own reasons curtailed the supply; but the plant now in existence at Cardiff and elsewhere would meet the need. It was a question whether the process might not be kept on after the war, to secure at least one-third of the benzol in the gas for use in chemistry or as motor spirit. He then referred to the closing passages in his paper relative to research work and financial return.

Some Remarks.

Mr. Blower said the papers were very interesting; but he would like to know how these things might be applied to the city. He had not heard any practical scheme, and suggested that a Committee might be appointed before the conference closed, so as to go into these matters, find out what steps could be taken, the capital required, &c., and produce a workable scheme.

Professor C. Thompson (Cardiff) said he did not think that it would be long before there would be no coke made in the district from which the bye-products would not be recovered. The difficulty, he was afraid, would be to dispose of the gas. The Powell Duffryn Colliery Company were selling gas for lighting and heating; but in another case negotiations were not successful. He did not know what had become of the gas at the Glamorgan Colliery ovens; but he believed it had gone under the boilers. The value of gas used in this way was extremely small. There was an immense amount of power which would go to waste if so much gas was made; and they should take into account that cheap power was essential. One suggestion was that crude coal might be brought to Cardiff, and the bye-product plant be established near the Dowlais works. The disadvantage would be the cost of carriage; but the gas produced would be in the place where it was wanted, instead of being wasted in the valleys. The proper utilization of power resources had become of the greatest importance, and must be dealt with.

Mr. Butterfield, in reply to a question, said that taking out one-third of the benzol would not prevent the gas giving a luminous flame in the ordinary flat-flame burner.

Professor Armstrong said in South Wales there must be great opportunity for saving; and it was important that there should be a qualified body of men to consider the matter. There was enormous waste of fuel, which might be ended by co-operative work. Unless they were fully acquainted with the resources of the district, no effective move could be made. Nothing could be done forthwith; but they could decide that they would not allow any bye-products to be wasted. They need have no fear of the over-production of sulphate of ammonia. Great quantities would be used in the cultivation of sugar-cane. He contrasted the action of sulphate of ammonia with that of nitrate of soda, showing that the former was preferable, especially on the rice fields. He hoped they would have nothing to do with the Government in these matters, for their schemes did not result in the origination of anything. The German discoveries had all been made in the works laboratories. When the product had been brought to a marketable condition was the time to go to the Government for financial assistance.

Mr. T. Vivian Rees (one of the leading commercial men of the port) emphasized the importance of training men in the schools and colleges for dealing with the new processes. When war broke out, he had personally made inquiries with a view to starting some of the industries previously in the hands of Germans; but though they could get plenty of expert advice, they could not secure the men with knowledge of the plant who would have to produce the actual output, and the scheme had to be abandoned.

Sir John Courtis (the Chairman of the Cardiff Development Committee), in moving a vote of thanks to the authors, said the need of the city was industries; and they were prepared to do everything possible to secure them.

Mr. Butterfield, responding, pointed out, in reply to a remark made, that while no one had laid down a definite scheme, all the authors had given a clue as to the direction in which opportunities lay. South Wales had a grand seaport and good fuel resources.

THE COAL TRADE AND ALLIED INDUSTRIES.

By R. H. Greaves, M.Sc., of University College, Cardiff.

[**A Paper read at the Cardiff Conference on the Extension of British Trade, April 20.**]

This paper, entitled "Some Notes on the Coal Trade and Allied Industries," occupied some 25 pages of printed matter, and dealt mainly with the aspect of our trade in coal and the bye-products in comparison with the trade being done by Germany during the years, generally speaking, from 1911 to 1913.

Coal.

The first part of the paper was directed to an examination of the position in connection with coal itself; and it was shown how the Germans have, during recent times, been developing their coal trade in the Baltic and North Sea ports and the North of France. Gradually they are extending their operations farther afield, and have been developing business in the Mediterranean markets—particularly in Italy. In the conservation of their coal supplies, they have set an example to Britain which it would be well to follow. In the case of German coals, there is a superiority in quantity; and although there is an inferiority of quality, yet by the fearless expenditure of capital in improving the means of production and marketing, they have been enabled to produce a commodity equal to our best North-Country coals. In fact, with the bye-products of their processes, they have created new trades in which they hold a supreme position, and have secured a monopoly for new industries which have been established and reared in Germany.

Patent Fuel.

The first industry dealt with by the author arising from coal was that of the production of patent fuel. In this country, South Wales is the home of the patent fuel industry, and contributes 96 per cent. of the total output of the United Kingdom. In 1913, for instance, South Wales produced 2,118,910 tons; the total for the United Kingdom being 2,213,205 tons. But in Germany the total production was 27,241,755 metric tons, of which 21,417,979 tons were lignite briquettes—the remainder being from coal. About 60 per cent. of the German production is for home consumption; and, with regard to the exports, it is noticed from the information given that, while Germany has secured the markets near at hand, there is little competition with the United Kingdom in more remote localities.

Attention was given by the author to the question of the difficulties of a suitable agglomerant in the manufacture of patent fuel. The only material which has proved satisfactory for South Wales coals is pitch of a definite consistency. But it has several disadvantages, the most obvious of which is its cost. Several efforts have been made to manufacture briquettes by doing away with a binder, and utilizing the properties of the coal itself for the purpose; but up the present there does not seem to have been any great success in this direction.

Coal Washing.

In a section dealing with coal washing, Mr. Greaves suggested that there is still room for an extended application of the system, especially in the case of the smaller collieries. He, however, regards the separate erection of plant at these smaller collieries as being uneconomical, and thinks that the better plan would be the establishment of central washeries of large capacity for the treatment of small coal from neighbouring sources. Incidentally, it is learned that in South Wales the average cost of washing amounts to about 3d. per ton; while the increased value of the washed coal varies from 5d. to 10d. It was suggested, also, that greater importance should be attached to the efficiency of the washeries installed in the South Wales district. The dirt passing away from the washery frequently contains over 20 per cent. of coal, and sometimes as much as 40 or 50 per cent.

Coke.

The next portion of the paper dealt with coke; and we cannot do better than reproduce a table showing the output of coke in South Wales, in the United Kingdom, and in Germany.

Table *showing the Output of Coke in South Wales, the United Kingdom, and Germany.*

Source.	1911.	1912.	1913.
From coke-ovens only—	Tons.	Tons.	Tons.
Glamorgan*	734,497	646,254	783,377
Monmouth	564,249	581,609	755,072
Total for South Wales	1,298,746	1,227,863	1,538,449
Do. for United Kingdom	11,474,174	10,720,352	12,798,996
From coke-ovens and gas works—			
United Kingdom	18,957,279	18,350,068	20,529,732
Germany	25,405,108†	29,141,070†	32,167,716†

* Including Denbigh. † Metric tons.

Another table sets forth the exports of coke from the United Kingdom and from South Wales. From this, it is gathered that

in 1913 the total exports of the United Kingdom were 1,235,141 tons, of which South Wales contributed 135,475 tons. In the same year the total exports from Germany were 6,411,418 metric tons. In the table giving the export of coke from Germany, a noticeable feature is the enormous market France provides for German coke—for 1913, 2,354,918 metric tons.

Proceeding, the author dealt with bye-product coking, and made comparisons of what is being effected in South Wales, the United Kingdom, and Germany. His statements indicate how rapidly the Germans have advanced in the production and export of the specialized products from coal tar. One observes the frequency with which increases of as much as 100, 200, and 300 per cent. in output have taken place during the last five years; and it is remarked that it is the more refined products which show the greatest advance. For example, while the output of tar and pitch has roughly doubled, that of pure and of 90 per cent-benzol has increased to three-and-a-half times its value in 1909; and while crude toluol shows an increase of 20 per cent., the increased output of purified toluol amounts to more than 650 per cent. of its value at the beginning of the five-year period.

In the table presenting these particulars, two items are specially interesting—the output of illuminating gas and electrical energy in connection with modern German colliery practice. The illuminating gas exhibits an increase of 450 per cent., and electrical energy of 180 per cent. in the period of five years. The gas is used for the purpose of town supply. To come to exact figures, the gas sent out from the collieries of the Dortmund (Westphalia) Mining Board District for town supply in 1909 was 25,271,738 cubic metres, whereas in 1913 it was 137,954,848 cubic metres.

Sulphate of Ammonia Production.

In connection with the subject of sulphate of ammonia production, the author quoted figures which are well known to readers of the "Journal" from the reports of Messrs. Bradbury and Hirsch and the Chief Inspector under the Alkali Works Act. He remarked that fear is sometimes expressed that, with the continued increase in output, the market for sulphate might be swamped and prices depressed; but, as a matter of fact, no such tendency has accompanied the enormous growth of production in the last few years. In support of this contention, he pointed to the figure ruling in 1893, when the average price was £11 17s. 5d. per ton, and that of 1913, when it was £13 10s. 2d. per ton. Yet during this period the world's output increased to more than six times the amount of 1893. Mr. Greaves referred to the activity displayed by the Germans in exporting sulphate of ammonia, and more than once to the great value of the newly-organized Sulphate of Ammonia Association in "keeping up the end" of the British output in the distant markets of the world.

It is clear, too, that the author places very considerable emphasis on maintaining the quality of sulphate of ammonia, in view of the fact that all German sulphate is guaranteed 25 per cent. ammonia. Japanese buyers, he says, now always insist on a guarantee of less than 3 per cent. of moisture, and less than 0·5 per cent. of acid. Therefore the question of purity is of the utmost importance, especially in regard to the export trade. It is also gathered that Germany, with its supply of nitrate of soda cut off, does not now produce enough sulphate for its own needs. This, of course, is only a temporary position, of which the British producers must take the utmost advantage.

In connection with the use of sulphate of ammonia in different countries, the author pointed out that in Belgium the quantity employed per acre of cultivated land is 17·83 lbs., in Germany 9·98 lbs., in England 5·35 lbs., in France 2·23 lbs., in the United States 1·34 lbs. He computes that there are 20 million acres of land under tillage in the United Kingdom; and the use of 1 cwt. of sulphate of ammonia per acre would result in a home consumption of 1,000,000 tons, instead of less than 150,000 tons as at present. Thus there appears to be enormous scope for its extended use, though progress in this direction is very slow.

The paper also made incidental reference to the synthetic process of producing sulphate of ammonia, as practised in Germany. Up to now, the author stated, the cost of any of the synthetic processes is probably prohibitive of a very large output; but unless the supply of sulphate of ammonia in England increases, to keep pace with the probable increased demand, the German synthetic product will be a formidable competitor.

Other Outlets for Ammonia.

Dealing with other outlets for the ammonia of gas and coke works, the author referred to the production of sal-ammoniac, muriate of ammonia, concentrated gas liquor, fluid ammonia, carbonate of ammonia, ammonium nitrate, and nitric acid. In connection with the last named, an interesting fact is noticed. The author remarks that the Wendle Colliery, in Westphalia, recover nitric acid from 170,000 cubic feet of coke-oven gas per day; the yield being about 12½ lbs. of nitric acid from 1000 cubic feet of gas. In normal times the nitric acid was costing roughly 6 per cent. more than its market price to produce; but with shortage of nitric acid for the manufacture of explosives, this source of supply has no doubt been of very great value to Germany.

Summing up the situation with regard to ammonia and its compounds, the author thinks it appears that, while a market for good quality sulphate is always assured, the position of the other ammonia derivatives is much more precarious, and mainly depends upon whether a local market happens to exist.

The Coal Tar Industry.

A large amount of information with regard to the coal tar industry followed; and here it is remarked that it is beyond doubt that South Wales can never as a producer of benzol play much part in any scheme for a complete coal tar industry. In regard to colour works, there is a consensus of opinion that the North of England is the most suitable place.

Conclusion.

On the whole, Mr. Greaves thinks it unreasonable to expect any very great developments immediately in connection with the South Wales coalfield in the industries with which he dealt in his paper; but he is of opinion that there is room for the more efficient working of existing coal-washeries, the extended utilization of small coal for briquettes, the more efficient application of gas from coke-ovens, improvement in the quality of sulphate of ammonia made, and co-operation in the development of coal and tar industries, with a view to securing a permanent output for the South Wales products.

COKE-OVEN BYE-PRODUCTS.

By Thomas G. Watts, B.Sc.

[A Paper read at the Cardiff Conference on the Extension of British Trade, April 20.]

In this paper the author dealt chiefly with the adoption of bye-product coke-ovens in Wales, where introduction has been at a slow pace. It is probable that the delay is due largely to the low volatile matter in South Wales coal. The bye-product plants are, therefore, quite a small proportion to the non-bye-product plants. In the coalfield, which raises some 50 million tons annually, the author remarks that the total number of bye-product ovens is only 694—representing roughly some 1,725,000 tons of coal carbonized each year. However, what coke is produced by this means is of a very fine quality; and the absence of any necessity to either compress the coal before charging, or to adopt special methods of quenching in order to produce a coke of good appearance and texture, has assisted in the popularizing of bye-products ovens in the district where conditions have made their adoption at all possible.

South Wales, it is explained in the paper, has some peculiar difficulties in the production of coke in bye-product ovens; and these offer discouragement in the way of profitable working. Chiefly, they are found in the saleability of the "smalls," and also in the lower yields of bye-products. The following table is given by the author to exemplify this matter:—

Bye-Product Yields per Ton of Coal Carbonized.

Bye-Product.	South Wales.	Yorkshire.	Average, United Kingdom.
65 per cent. benzol .	1 to 1½ gallons	2½ to 3 gallons	2½ gallons
Tar	56 to 68 lbs.	112 lbs.	89½ gallons
Sulphate of ammonia	18 to 20 lbs.	22 to 35 lbs.	24 lbs.
Gas	8000 to 10,000 cubic feet.	10,000 to 11,500 cubic feet	10,000 cubic feet

Some consideration is therefore necessary before adopting bye-products plant in the South Wales district. There is, however, a feature which tends to improve the outlook. It is that the price obtained for bye-products remains relatively stationary, and the yield of coke may always be reckoned on as over 75 per cent. of the coal charged.

Types of Ovens.

For profitable working, the plant must be sufficiently large to reduce the cost of production; and in this connection the author discusses the present modes of production, possible improvements, and new outlets for the products. In the first place, he refers to the different types of ovens—dividing them into four heads: (1) Regenerative; (2) waste heat; (3) vertical flued; (4) horizontal flued. Experience in the South Wales district seems to point to an easy advantage in the selection of the vertical flued type; this being due to the fact that South Wales coals have several peculiarities in respect of their transference into coke. One of these is the high temperature required for complete carbonization; another, the transitory expansion of the coal during the coking period. In view of this, long lengths of brickwork having no strengthening ties is an impossibility, owing to the liability to give way under the stresses of an expanding charge. This is the reason for the majority of South Wales plant being of the vertical type.

Bye-Products.

Discussing the bye-products derived from the manufacture of coke, the author enumerates them as follows: Gas, ammonia, tar, which subdivide into benzol (by gas washing), sulphur (by gas purification), cyanide production (from the gas), production of sulphate of ammonia (from the ammonia), light oil, phenols, naphthalene, creosote, anthracene, oil and paste, pitch (all from the tar).

Gas Produced.

In regard to the gas produced, the author points out its uses in several ways. Among the uses, of course, is that of its applica-

tion for town supply, concerning which he makes some remarks concerning the recent negotiations between the Rhondda Urban District Council and the Glamorgan Colliery Company with reference to the utilization of the surplus gas from the ovens at Llwynypia. Observing that the negotiations were abandoned, the author says: This does not, however, prove that the gas was unsuitable, or that the idea was impracticable. The gas was offered to the Council at 7½d. per 1000 cubic feet. The estimated amount to be supplied was 2 million cubic feet per day. The retail price of gas by the Council was 4s. 3d. per 1000 cubic feet, leaving an apparent margin for expenses and profits of 3s. 6½d. per 1000 feet. It would, therefore, appear that there was ample advantage to be secured from the acquirement of this gas by the Council—particularly when it is remembered that a similar quality of gas is being sold by the Powell-Duffryn Company to Bargoed for town lighting.

In regard to the German output of surplus gas from their bye-product ovens in the Dortmund district of Westphalia, the author quotes figures which show that 25,271,738 cubic metres of lighting gas were produced in the year 1909, and 137,954,848 cubic metres in 1913. Looking at these figures, the author considers that the abandoment of the Rhondda scheme was a retrograde step, and the subsequent period of uselessness which befel this surplus gas is much to be deprecated.

Benzol Recovery.

Passing on to the question of benzol, it is stated that its recovery from coke-oven gas in the South Wales district has found little popularity. In the whole of the coalfields only three plants are recovering benzol, and the quantity obtained is not large. In this connection the author gives an analysis of the gas produced from a mixture of steam and bituminous coal of average volatile content for the mixture of 20 per cent. It is obvious from the analysis that the gas is not the sort from which to expect much of a benzol yield.

It may be interesting to reproduce the benzol result of carbonizing a coal with a volatile matter to the amount of 29·93 per cent.

Crude benzol	2 gallons per ton of coal carbonized.
	Rectification.
90 per cent. benzol	1·30 gallons per ton of coal carbonized.
50 ,, ,,	0·36 ,, ,, ,, ,,
Solvent naphtha	0·13 ,, ,, ,, ,,

These results are larger than may be expected from the majority of plants in South Wales; and it may therefore be argued that the recovery of benzol is scarcely worth while.

Sulphur and Sulphate Recovered.

Turning next to sulphur, the author states that the total present in the coal of the district, such as is used in bye-product plants, amounts to an average of over 1 per cent. Of this, practically 0·80 per cent. remains in the coke, leaving the balance of more than 0·20 per cent. in the gas. In only one plant—that of the Powell-Duffryn Company—is the sulphur recovered, although there is more than sufficient in all coals, if totally recovered, to supply enough sulphuric acid for the sulphate plant. Then very little work in connection with the recovery of cyanides from the gas and from waste liquors has been done.

Regarding the production of sulphate of ammonia, the author quotes the letter sent out by Mr. D. Milne Watson, the Chairman of the Sulphate of Ammonia Association, as to the quality of sulphate for export purposes. In this conjunction, the author remarks that there is no doubt much can be said on the question of quality; and "although the position may not be so bad as the Association would have us believe, there is quite an appreciable amount of evidence to the truth of their statements."

Next discussed are the various systems of producing sulphate of ammonia, and in this connection references are found to the Koppers system, and to that of Dr. Hilgenstock. In regard to the Koppers process, the author remarked that it is scientifically sound, and a fine quality salt is produced. The advantages gained are: No scrubbing water is required; therefore reducing the amount of water which has to be dealt with by the still, and less effluent to pollute rivers. The latter is a serious item in some parts of the country, where county councils and river boards have to be considered. Also there is an economy in heat units. The objection lies in having to use a still to recover the ammoniacal liquors which are derived from the moisture in the coal charged. The advantages of the Hilgenstock plant are: It dispenses with separation tanks for tar and ammonia liquor, condensers, and water for same, liquor circulating pumps, lime mixers, stills, steam connections, and steam in sufficient quantity to work the stills (which is no small matter). Truly a large quantity! There are some objections, however, which are admitted. One is the temperature of the gases, and the reaction heat produced by the ammonia and sulphuric acid in the latter, and which external heat has to be supplied to avoid condensation. Mr. Ernest Bury has found that this matter turns on the percentage of ammonia in the coal. Other objections which have been put forward are the non-removable quantity of tar, and the subsequent colouring of the salt. This is a matter for works practice; and there is no doubt that good white salt can be obtained by the process.

To the author's mind the production of sulphate of ammonia direct from the ammonia in the gas, and the sulphuretted hydrogen also in the gas, is a problem which at some time is going to be solved, and is worthy of the deepest consideration of chemists. Once conquered, it will revolutionize the whole process of bye-product coking and well repay the inventor. The encouragement of research in this direction should clearly be an undertaking of the conference.

Tar.

Regarding tar, the author considers it a moot question whether the distillation of tar should be carried out at the coking plant or the tar transferred in tanks to distillers. He looks upon the multiplication of tar-stills as an advantage, in that the competition brought about by the distillers finds fresh outlets for their products by the endeavours of the several manufacturers. He therefore submits that where the output of tar is large enough—that is to say, at least 40 tons a week—it is preferable to carry out distillation at the ovens, where cheap fuel is available. The tar of the district, however, yields very little light oils, much pitch, and a large proportion of solid matter, as naphthalene and anthracene paste. In the position the demand now is, this is somewhat against the distillation of tar; for the yield of what may be actually termed oils is low. It is some compensation, however, that the yield of pitch is high—amounting in most cases to 50 per cent. of the tar distilled.

An analysis of a tar which is representative of most coke-oven tars in the district gives the following results:

	Per Cent.
Ammoniacal liquor	2·60
90 per cent. benzol	0·05
50 per cent. benzol	0·12
Solvent naphtha	1·25
Naphthalene	6·80
Creosote and middle oil	16·00
Anthracene oil	11·66
Anthracene paste	16·44
Pitch	45·08

Returning to the question of the possibility of a greater production of small coal, the author remarks that the amount of "small" associated with the raising of bituminous coal in the district is some 50 per cent. of the total. It is to the bituminous coals of the district that we look for an extension in bye-product coking; and therefore, in the opinion of Mr. Watts, it is a pity efforts are not made to bring more of this small to the surface.

Finally, the author discusses the question of *personnel* in the organization and control of coking processes. He regards these as offering the chemist a true sphere—chemists trained either in University or Technical School. There, however, seems to be some disapproval of such men on the part of proprietors; and the author thinks the Universities are not altogether blameless, in that they are in many cases producing men who cannot look beyond the laboratory table. In Germany, the amount of money spent by private firms on the equipment and *personnel* of their laboratories would shock the average English manufacturer.

COKE-BREEZE BRIQUETTES.

An article in the "Journal für Gasbeleuchtung" of the 6th of March, by Herr Behr, the Manager of the Gas and Water Works at Kolberg, describes experiments which the author has made during the past six years on the briquetting of coke-breeze, and the plant which, as the result of the experiments, has been installed at the Kolberg gas-works for making briquettes.

The author remarks that the utilization of coke-breeze on gas-works for firing boilers, either with or without admixture with thick tar, necessitates the use of suitable grates, blowers, &c. The flues also rapidly get choked, and much unconsumed breeze is lost owing to the action of the blast. The use of coke-breeze in specially constructed suction producers leaves little to be desired as regards economy and complete consumption; but there are not sufficient of these plants to utilize much of the breeze, and in many cases local conditions would preclude their use. For other uses of the material—such as for pathways, and as a filling for walls and floors—the demand has fallen off owing partly to æsthetic prejudices, and partly to fine clinker being preferred. The cheaper clinker is also increasingly used in place of coke-breeze for concrete work, especially in walls and in the manufacture of artificial pavement, tiles, &c.

Having regard to these considerations, the author proceeded to study the manufacture of briquettes from coke-breeze. At first he tried preparing them in the cold, using as a binder, among other materials which were ultimately put aside as too costly, a waste product from cellulose works. The method, however, proved too troublesome and costly, as it was necessary that the briquettes should dry in the air in the same manner as artificial tiles. The manufacture in the cold having given no really practical result, experiments were made with hot materials. The process which gave the best results was the compression of the breeze after the addition of finely divided hard pitch and heating the mass to 300° to 400° C. Experiments with other binders—such as both thin and thick tar, with an addition of sawdust and coal dust—all failed in respect of ease of ignition. The author learned that there was a briquetting apparatus in use for coke-breeze at the Riga gas-works which had given good results, and another plant at the Tegel gas-works in Berlin. A calculation based on the Riga works results showed that the briquette making press ought to give a good return at the Kolberg gas-works. That his conclusions were justified is shown by a calculation of the return from the plant

after it has been in use at the Kolberg gas-works for over five years, which is sufficiently long for the cost of repairs to be fairly ascertained. The calculation of the return from the plant has been based upon the assumption that it produces briquettes for domestic use of cylindrical shape, 2½ by 2½ inches, and that the whole of the production can be sold at the price of 8¼d. per cwt. Far more favourable results would be shown if the practice of the Riga gas-works were followed, and larger briquettes, 4 inches in diameter, were manufactured for consumption in gas-producers. The latter briquettes may be used in the producers of retort-furnaces to the extent of half the coke which would otherwise be consumed in the producers; but there is, of course, the objection that they are charged into the producers while cold, whereas the coke can be put in hot. The use of the briquettes for this purpose, however, sets free half the coke which would otherwise be used for retort-house fuel; and the difference (in Germany) between the selling prices of the coke briquettes and large coke is on the average 3d. per cwt. in favour of the latter.

The author proceeds to give a brief description of the briquetting plant, which consists of a press with mixing-machine, elevator, furnace, and mill for grinding the hard pitch. The press, driven by a belt from a power shaft, or direct by a steam-engine or gas or electric motor, is a single one, with a moulding table so constructed that, with the addition of a few parts, it can be converted to a double press. In direct communication with the press is a mixing-machine, which mixes the breeze intimately with the hard pitch powder. The mixed material is raised to the mixing funnel by means of an elevator, which automatically brings as much material into the funnel as corresponds with the output of briquettes, thus keeping the material at a constant level in the funnel.

A furnace attached to the plant superheats live steam, taken from a boiler, to a temperature of about 350° C., by passing it through a double worm inserted in the furnace. A safety valve is provided. The furnace is also furnished with a blower, by means of which the waste gases are taken away to the mixing funnel. These hot gases are necessary, as well as the superheated steam, for the manufacture of hard briquettes. The mill for grinding the hard pitch is close alongside the press, and is driven from the same power shaft.

The procedure followed in making the coke-briquettes is that the fine coke-breeze, mixed with 6 per cent. of hard pitch meal, is tipped from the trucks into the receiver of the elevator, by which it is raised to the funnel-shaped mixing-machine, the stirring gear of which mixes the breeze and pitch meal immediately. The superheated steam and the hot flue gases drawn from the furnace are passed into the mixing-machine, the contents of which are thereby heated to such a temperature that the hard pitch melts. The highly heated mass passes through an outlet at the bottom of the mixing machine into a filling vessel which is placed immediately above one-half of the moulding table, which is rotated at regular intervals. As the moulding table turns round, the cylindrical openings in it are filled with briquetting material from the filling vessel. After the cylindrical hollow space has been filled, the next movement of the table, by some 60° about its vertical axis, brings the cylinder under a compressing stamp, which compresses the 4-inch long briquette to 2½ inches. A further turn by 60° of the table brings the briquette under a spring pusher which expels it from the moulding table. The briquette falls on an inclined shoot, whence it drops into a truck, which is changed when required. The compressed briquette, though still quite hot, is firm enough to withstand transport and handling by means of coke-forks. On cooling, the structural hardness of the briquette increases greatly. It has been found that the briquettes are better and harder the finer is the coke-breeze. Moisture in the breeze, amounting to 5 per cent., does not spoil the briquettes; hence the breeze can be stored in the open.

In regard to uses for the briquettes, this small 2½ by 2½ inch size may be used in all cases where the layer of fuel is not less than 8 to 10 inches. Good chimney draught is obviously desirable—*i.e.*, such as is required for ordinary 2-inch coke. The old types of Continental tiled stoves with shallow fuel beds are not suitable for coke-briquettes, though the more modern tiled stoves, intended for coke, answer well with briquettes. The best results, however, are obtained in closed iron stoves, central heating plant, &c., in which 50 to 100 per cent. of the fuel ordinarily used can be replaced by coke-briquettes. Like any novelty, it has proved rather difficult to introduce the use of coke-briquettes. It is necessary to show a small stove burning the briquettes to convince people that they burn well. The author has pushed their sale by newspaper advertising, and by supplying samples gratis.

When the coke-briquettes were introduced about six years ago they did not give great satisfaction; but these were the larger ones, 4 inches diameter, and they were not as hard as the later ones. After the small 2½ inch briquettes had been introduced, many householders took kindly to them, and now at times the output does not meet the demand. The result of the introduction of the briquetting plant at Kolberg has been not only to dispose entirely of coke-breeze produced on the works, but coke-breeze has been bought from other works to work-up into briquettes.

The author points out that in the working, especially on hot summer days, the coke and pitch dust troubles the eyes of the workmen if the plant is located in a closed building. This trouble does not ensue if it is in a lean-to shed, or other equally open structure.

In reckoning the cost of manufacturing briquettes the author assumes a working day of 10 hours, in which time 70 to 75 cwt. of the briquettes are produced by one press. The double press, which would only involve an increased capital expenditure of about £50, would give much more favourable results. Taking a minimum production of 69 cwt. of briquettes in 10 hours, and assuming that the man who looks after the press also attends to the grinding of the pitch, the raising of the breeze, the mixing of the two, the removal of the finished briquettes, and the furnace for superheating the steam, the following is a calculation of the cost of working at Kolberg.

The 69 cwt. of briquettes, containing 6 per cent. of pitch, will consequently consist of 7264 lbs. of coke-breeze, and 464 lbs. of hard pitch. The costs are therefore:

	£	s.	d.
Coke breeze, 7264 lbs., at 6s. per ton	0	19	5
Hard pitch, 464 lbs. at 40s. per ton	0	8	3
Wages, per day of ten hours	0	3	0
Steam and power requirements and briquette fuel for the furnace	0	1	6
Depreciation and interest on the plant	0	1	0
Repairs	0	0	5
Maximum cost of 69 cwt. of briquettes	£1	13	

Consequently the cost of manufacturing the briquettes is 5¾d. per cwt. Since the lowest selling price is 8¼d. per cwt. on the gas-works there remains in the least favourable circumstances a profit of 2¾d. per cwt., or 4s. 7d. per ton. The power consumption, depreciation, interest, and repairing charges are taken on a very liberal basis; being on the average about 25 per cent. higher than is usual. The cost of the complete briquetting press at the Kolberg gas-works was £189, and the erection of it, the shed, the pitch grinder, and furnace cost £36; so the whole installation cost £225. The present plant, with one press working 300 days of 10 hours in the year, produces 1050 to 1125 metric tons of coke briquettes per annum. A double press would give double this output. In favourable conditions the cost of a whole installation with a single press would be repaid in a year.

A DEFECTIVE SUBMERGED GAS-MAIN.

All gas people who are interested in the question of "Cast-Iron *v.* Steel Tubes" will regard the following case as of some importance. The particulars are as communicated by a correspondent in Holland.

The little town of Velsen, situated near the North Sea Canal, in Holland, does not possess its own gas-works, but buys gas in bulk from the Haarlem Gas-Works. For this purpose Velsen erected a gasholder and started a distribution department. As the area in question is on both sides of the North Sea Canal, the transmission of the gas had to be effected through a submerged main, made of Mannesmann tube. The keeping of the syphon dry involves this difficulty—that the canal has deep-water levels (as it forms the connection between Amsterdam and the North Sea) which prevent the syphon being freed from water by pumping, as it is laid more than 10 metres below the surface. Special measures were therefore taken; the water being pumped by means of a "Pulsometer." The main worked satisfactorily for about three years; the drainage water being cleared out every three months. Suddenly on Christmas day last the gas-works had a message over the telephone from a metal-works on the other side of the canal, that they had no gas supply. On investigation it was found that one side of the main which had up till that day always kept perfectly clean and dry, was totally filled with water. As soon as possible the water was pumped out; but it was night before any fresh gas supply under holder pressure was possible, and normal pressure could not be given before 1.30 the following morning.

In order to keep the gas-way free, it was deemed necessary to pump water incessantly day and night for three days—a very costly job, as three men were required for the work. However, Messrs. George Wilson and Co., of La Haye, offered to make a pump of special design, and at their own risk. The offer was accepted; and on Jan. 14 the pump was placed in position. The results proved to be a success, as one man was sufficient for pumping all the water out in about twenty minutes. A week afterwards (some 24 hours after the last pumping had been done) the gas supply was again cut off; the main being once more filled with water. From this it was evident that the leakage had seriously increased; so that it became necessary to pump night and day all through the week.

It so happened, however, that there was a new water-main laid through the canal, and which had not till then been in use. It was decided to make the best of it, and the necessary preparations were effected for getting a 2-inch connection with the gas-main; so that the water-main might be temporarily used for gas-supply. In the course of the work the leakage in the gas-main decreased considerably, for which there was no cause assignable except that some obstacles had temporarily shut-off the leak. This proved true; for a fresh movement obviously removed the obstacles, and on Feb. 16 the leakage increased to such an extent that the dry water-main had to be put to use as a gas-main.

Owing to this, there have been several proposals made for laying a new main, but not of Mannesmann tubes. A cast-iron main is suggested, the cost of which is calculated to be about £2920—a big deficit for a gas department only three years old.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

Annual Meeting.

This Meeting was held in the Heriot Watt College, Edinburgh, last Saturday—Mr. J. J. Scott, of Kennoway, the Vice-President, presiding in the absence, through illness, of the President (Mr. R. B. Chalmers).

Annual Report and Accounts.

The Secretary and Treasurer (Mr. Laurence Farquhar) in submitting the eleventh annual report, stated that the membership had decreased by eleven—greatly due, no doubt, to the present national crisis. One member (Mr. J. Fleming, of Falkirk) had been lost through death. In the circumstances, it was considered that the attendance at the meetings had been satisfactory.

Mr. William Geddes said that while the plea had been put forward that the decrease in membership was due to the war, he thought the cause had to be sought deeper than this. If next session's proceedings were to be of the same curtailed nature as those of the past session, there would be a further reduction in the membership. He suggested that, if the war was still going on, they should seriously consider the steps to be taken for carrying on the business of the Association during the forthcoming session, and whether the curtailment of visits and meetings was necessary. There should be a purely nominal subscription next session of 1s., which would carry on the Association till they returned to normal times.

Mr. W. B. Carson supported the suggestion of a reduction in subscription.

Mr. John Moyes said that members at the front should not be allowed to fall out of membership.

The Secretary pointed out that this had been seen to.

Mr. Hamilton asked whether there was anything to prevent them carrying on business as usual next session.

The Chairman pointed out that visits to works created expense to the manufacturers. He moved that next session they arrange for meetings at the various centres, not visits but meetings, and that they have six or eight meetings with discussions and lectures, and that the usual subscription be retained.

Mr. Hamilton seconded the proposition.

Mr. Geddes explained that his suggestion as to reduced subscriptions was only because the members would be receiving very little benefit during the forthcoming year. If there were to be six or eight meetings, then the subscription should remain at 6s.

Mr. Carson proposed that they remit the question regarding next year's programme to the executive, with the proposition that, in the event of it being decided to have a programme similar to that of the past year, the Council take into consideration the question of reducing the subscription.

Mr. Moyes seconded; and on the vote being taken Mr. Carson's amendment was adopted.

The accounts for the past year showed receipts (including the balance brought forward of £9 1s. 8d.) amounting to £31 19s. 8d., and outlays £25 15s. 10d.; there being £6 3s. 10d. carried forward. The Chairman said he considered the position of the finances most satisfactory in the circumstances.

The Secretary pointed out that a guinea had been sent to the Prince of Wales's Fund.

Office Bearers for 1915-16.

The following office bearers were elected: President, Mr. J. J. Scott; Vice-President, Mr. Laurence Farquhar; Secretary and Treasurer, Mr. Robert Scott (Cowdenbeath). In place of Mr. Aitken, Member of Council resigned, Mr. Carson was appointed; and the new Members of Council in room of Mr. Gourlay, Mr. M'Millan, and Mr. J. Simpson (retired), were Mr. William Mann (Auchterarder), Mr. C. Hamilton (Loanhead), and Mr. William Geddes (Granton).

"ARE WE SHOP-KEEPERS?"

Mr. J. J. Scott then read a paper on the above subject.

In the course of a short paper, which was prepared with the idea of giving rise to a good discussion, the author said: The shopkeeper, or, to be more correct, the merchant, is possibly the oldest trade in the world, for without buying and selling the world could not go on; so we might just consider for a short time how this shop-keeping business helps us in our sales of gas. We are all aware of the usual methods of the shopkeeper. The manufacturer or selling agent brings before him something new, something that is sure to catch on with the public; and he immediately makes a special show of this article in his window. The attention of his customers is arrested, they try it and find it useful, and its further sale is assured. It is the same in every trade or business. Not only does he make a show in his window, but he backs this up by advertisement in one form or other. But you ask what this has got to do with the selling of gas. Are we, gas managers, assistant managers, superintendents, &c., to become ordinary shop-keepers? Precisely so. That is just what I mean; and it is with a view to find out how best we may do it that I venture to bring the subject before you to-day for discussion.

I would divide-up the various methods under three heads—(1) The gas supplier who supplies gas only; (2) the gas supplier who tries to push the sale; and (3) the gas supplier who does push the sale. There are still gas-works in Scotland, I am sorry to say, who must be classed under the first head. They do nothing in the way of opening a show-room or trying to bring before the gas-consuming public any new or useful apparatus which would be a benefit to the consumer and a profit-earner to the gas supplier. Happily, this class of undertaking is disappearing, and possibly in a short time will be non-existent.

Many undertakings may be classed under the second head; and this is where the shop-keeping business comes in. The first thing a "trier" should do is to get a shop or show-room, situated in the principal part of the town, if possible. It should be well lighted and well ventilated, and should contain a choice selection of the season's goods. The winter "show" should consist of gas-fires, radiators, geysers, incandescent burners, mantles, glass of all kinds, and everything suitable for winter use. A special show should always be put on at Christmas time, which might include fancy bead shades, enamelled table burners for kettles, nickel-plated gas-irons, &c.—all suitable for presents. The summer show, of course, would be cookers, grillers, hot-plates, water-heaters, wash-boilers, &c., &c. Then all this should be backed up by the gas supplier doing his best to get his goods introduced. There is a question I would like to hear discussed to-day as to whether gas-fires should be given out on hire or sold at a low price and fitted free. Also, what should be done in the way of fitting incandescent burners and maintaining them, and whether cookers should be on simple hire or hire-purchase; whether gas should be sold at a cheaper rate for cooking and heating; and so on.

Those coming under the third head, are the undertakings that go the "whole hog"—free cookers, free fires, water-heaters free and on hire, lamps on hire, free maintenance of all burners and appliances, attention of all kinds given to consumers, lady lecturers and visitors, free slot-installations, &c. The whole success of this shop-keeping business (or, as I may now call it, our sales department) depends entirely on our being able to cater for the public, and finding out what is going to be most popular. It is the mass we have to serve; and if it can be proved that free cookers are more popular than hired ones, then free cookers it should be, as the popular system will no doubt turn out the best paying one. I am aware there is great difference of opinion as to whether cookers should be given free or hired, and so on; and no doubt local conditions are to some extent the deciding factor. But through it all we must put ourselves in the shopkeeper's place, if we want to get into close touch with our consumers and increase our business and our profits.

Mr. Mitchell expressed the belief that in the hiring-out and fixing free of gas fires and cookers, &c., they were working in the interests of the consumers, and were also "getting their own back."

Mr. J. R. Moyes (Edinburgh) declared the supplying free of cookers was a step in the right direction; but they should see that the cookers were not used merely as stores for dusters, &c. The case of gas-fires was different in Scotland, because there were so many sizes of grates. Therefore he thought fires should be hired. If they were to be maintained in radiants, then a small hire should be charged.

Mr. G. P. Mitchell (Dundee) remarked that in Dundee there were about 5000 fires supplied free, and every maker had a fair share.

Mr. W. B. Carson (Edinburgh) held that many people who would never think of paying hire for small grillers or hot-plates would willingly use them if they were supplied free. When proprietors approached him *re* gas-fires he always recommended hire-purchase.

Mr. Hamilton asked if there was such a thing as free cookers. After all, they got the interest on their money from the gas. It was taken out of the pockets of the whole of the consumers; whereas if 5 or 10 per cent. were charged to users of cookers, the cost would be borne by them alone.

Mr. R. Scott (Cowdenbeath) said his first show-room, which was opened twenty years ago in the West of Scotland, consisted of a window in a shoemaker's shop. Local conditions, he contended, would decide what they had to do in their business. Free cookers had undoubtedly been a paying "spec." If the gas authorities had not taken them up, either on hire or free, there would have been very little work for the makers. He admitted, of course, that the business was mutually advantageous. It was natural in the case of hired cookers that the user should ask a reduction in the price of gas. He had suggested to his Directors that they charge full price for the gas, but that the cookers be given for nothing. If hire was charged, then, as a consumer, he would ask for discount. Gas-fires, however, were different, because they were used in winter, when they did not want them—that was if they were short of plant.

We learn from the number of the "Journal des Usines à Gaz" lately to hand that the three Associations representing the technical and commercial sides of the gas industry in France—the Société Technique du Gaz, the Syndicat Professionnel, and the Comité Central des Cokes—have each decided to send to the Association des Gaziers Belges a sum of 2500 frs., in token of their sympathy with their Belgian colleagues, and in alleviation of any urgent cases of distress which may have arisen as the result of the disastrous events of the past few months.

REGISTER OF PATENTS.

Control of Gas to the Burners of Steam-Generators.

JUSTICE, P. M.; a communication from the DOMESTIC APPLIANCES COMPANY, of New York.

No. 1433; Jan. 19, 1914.

This invention, relating to gas-heaters for steam-generators and the like, has for its object to provide a form of safety arrangement for preventing access to the combustion chamber until the gas-valve is shut off; the valve being locked in a closed position while the combustion chamber is open. Further, if a pilot is used, the arrangements include means for preventing the gas being turned on to the pilot light without first turning off the gas to the burners, and also means for preventing the extinguishing of the pilot light without shutting off the supply of gas to the main burners, and also for preventing the supply of water to the generator or heater if the pilot light valve is closed.

The invention is said to be particularly applicable for use with the steam-generators described in patent No. 14,496 of 1911; and it is shown in the drawings accompanying the specification as applied for use as a vacuum cleaner.

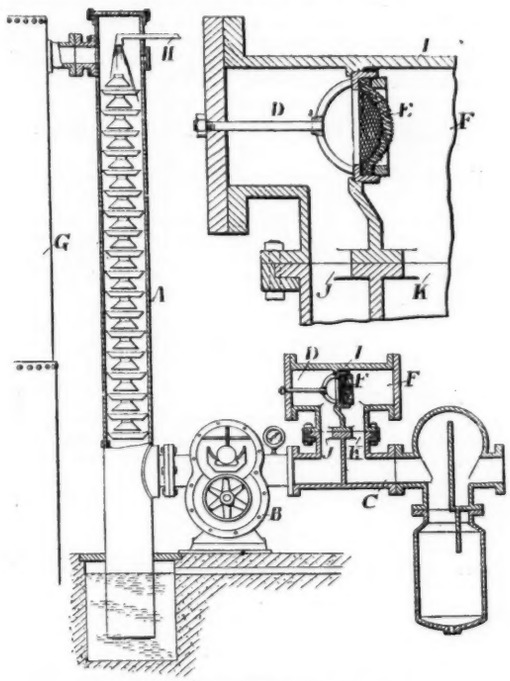
Purification of Gas.

SMITH, H. F., of Lexington, Ohio, U.S.A.

No. 11,246; May 6, 1914.

This invention has for its object to pass the gas through a pervious diaphragm or medium under suitable pressure, so that particles of tar, &c., will come in contact with the diaphragm and "be caused to coalesce and precipitate—the attraction of the tar particles and the precipitation of the particles (or any other particles that may be present in the gas) on the pervious medium being caused by passing the gas through a diaphragm at a sufficient velocity to create friction or static electricity to attract particles."

It is the removal of the small particles of tar vapour or fog that, according to the patentee, constitutes "the principal difficulty in connection with cleaning gas." These particles are approximately one ten-thousandth of an inch in diameter; and in unclean producer gas there may exist from 10 to 20 million of these small particles to a cubic inch. The particles are so small that they are carried in suspension in the gas current for an indefinite period, and will separate out of the gas with great difficulty and at extremely slow rates.



Smith's Gas Purification Plant.

The object of the porous diaphragm which constitutes the active element of the invention is not to remove the tar from the gas, but to bring about such a combination and agglomeration of the tar particles that they will then be too large to be carried forward by the gas current, and will be dropped out and separated from the gas by gravitation or by any of the ordinary processes employed for separating suspended liquids from gas. The pervious diaphragm does not act after the manner of a filter, "because a filter entraps and retains the particles, whereas the object of the diaphragm is to cause the coalescence of the particles contained or carried by the gas, so that after they coalesce and are increased in size, due to the coalescence and agglomeration, they will be carried through the porous diaphragm by the velocity of the gas passing through the diaphragm; and as the particles have now become heavier than the gas, due to their increased size, they will drop out by gravity and separate themselves from the gas."

A view is given of the apparatus (part in section and part in elevation); also an enlarged detail vertical section showing the connection of the casing and cage and the mounting of the diaphragm in the cage.

The producer G has a scrubber or cooling chamber A connected to it through which the gas passes, and during its passage is subjected to a spray of water from the pipe H for the purpose of cooling it. The scrubber is connected to a gas-pump B, attached to which is a casing C, which is provided with two chambers separated from each other by a partition. One chamber is provided with an outlet port J, and the other with an inlet port K. Mounted upon the casing C is a cage I capable of rotating upon the casing. It is provided with chambers D F, separated by a partition provided with an opening leading to a pervious or "filamentous" diaphragm E mounted in an annular frame. A fairly coarse wire screen is placed on each side of the filamentous material for the purpose of relieving undue pressure upon the diaphragm, which is "generally able to withstand the pressure of the gas which passes through it;" but to afford additional strength to the diaphragm, on each side of it is a wire screen, so that "its shape is not changed by the pressures brought to bear upon it."

After the gas has been cooled to cause condensation of the tar vapours, it is conducted, by means of the pump B, to the chamber D, under such pressure that the gas will pass through the diaphragm E, which is made up of a series of layers of fibrous material—such as spun glass (glass wool), wool felt, silk, hair, granular and porous materials—or metal screens or wire can be used to produce the effects intended. "Spun glass or glass wool is preferred, as the fibres are sufficiently stiff and elastic to retain their shape under the pressure required; and since the glass is entirely indifferent to the action of moisture or chemicals, the strength and resistance of the porous diaphragm is not impaired through the absorption of moisture or the deleterious action of chemical constituents in the gas or tar handled."

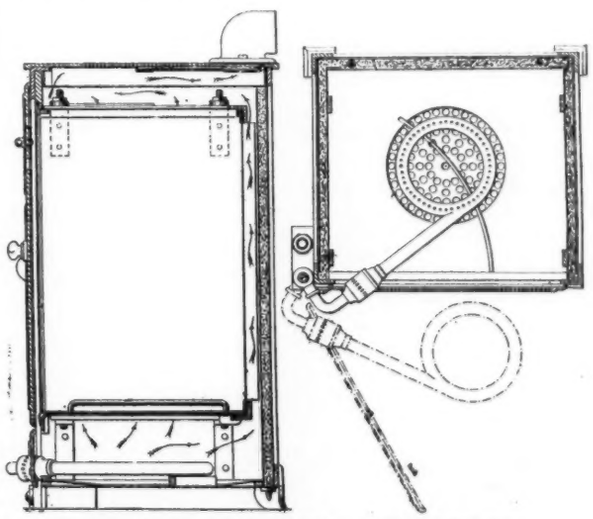
The result to be obtained by the invention is said to depend upon the pervious diaphragm, together with the high velocity at which the gas passes through the minute openings in it. The fibre of the diaphragm is matted together in the form of a disc approximately $\frac{3}{8}$ inch thick and having a sectional area of about 1 square inch for each 400 cubic feet per hour of gas which it is desired to clean. The area of the diaphragm must be so small that when the gas is flowing through, a difference in pressure of from 1 lb. to 5 lbs. shall be maintained across the diaphragm.

Gas-Ovens.

SOUTH METROPOLITAN GAS COMPANY and CHANDLER, D., of Old Kent Road, S.E.

No. 23,552; Dec. 4, 1914.

The oven to which the present invention relates consists of a closed chamber heated externally, and which has no inlet or outlet for air except a small ventilator in the door (or the door itself) through which access is obtained to the interior. The oven is enclosed in an outer casing which may be lagged in any convenient manner. The floor, side walls, and top of the oven are made removable in such a manner that they may be taken out for cleaning and replaced with great facility. The burner for heating is contained in a closed-in space beneath the floor. The hot gases from the burner pass from beneath the floor to flues (at the back and sides of the oven) which open at the top into a space in close proximity to holes through which the gaseous fumes escape on the way to the chimney.



Chandler's (South Metropolitan Gas Company) Gas-Oven.

The front elevation and cross section taken just above the ring burner show the general construction of the stove. The heat from the burner passes up the space outside the walls of the oven to a space (above the top plate) covered by a plate extending quite across the interior of the casing and having outlet holes near the front. The hot products from the burner which rise up outside the sides of the oven are prevented from making a direct exit through these holes by wing plates. On the upper side of the covering plate are guiding-pieces, which lead the combustion products towards the chimney near the rear of the oven. Within the chimney is a tipping valve or damper, to the axis of which is connected a spindle, preferably connected to the gas-tap, so that the turning of the latter off and on automatically moves the damper within the chimney and regulates the opening in accordance with the height of the flame being burned. The smaller the flame, the narrower will be the outlet for the combustion products needed. A gas-oven of this description, it is said, is "perfectly efficient, easy to use and to regu-

late, cheap to construct, and very easy to clean." The patentees' claims for it are: 1. A gas-oven contained within a box or casing wherein the floor, side walls, back, and top consist of plates loosely inserted and supported on angle-irons mounted on brackets fixed inside the box or casing. 2. In conjunction with such an oven, a space below the floor communicating by side and back flues between the walls of the oven and the casing with a space above the oven.

Incandescent Gas-Mantles.

MORE, I., of Ashburton, New Zealand.

No. 14,973; June 23, 1914. Convention date, March 13, 1914.

In a previous application (No. 19,852 of 1913), it was proposed by the present patentee to strengthen a mantle by the application of a mixture of china clay and water with the addition of permanganate of potash—all in certain specified proportions. In practice, however, he says, "it has been found that the process was impracticable."

The present invention consists in treating the finished, but unvarnished, mantle with a mixture consisting approximately of the following constituents:

Refined white china clay .	100 parts by weight.
Potassium permanganate .	1 part by weight.
Pure water	7500 to 8000 parts by weight.

The potassium permanganate and china clay are thoroughly mixed with the water (so that the former will be dissolved and the latter brought into a state of suspension) by agitating or stirring the mixture. The mixture is applied to the unvarnished mantle, so as to produce a thin coating, by spraying it lightly or by blowing it through an atomizer "so as to produce a fine mist which settles smoothly and evenly over the whole surface of the mantle, the liquid being maintained meanwhile in a state of agitation to preserve the suspension of the china clay."

A light coating having been thus deposited upon the mantle, the latter is then heated to incandescence, "which has the effect of burning-on the mixture, and so causing it to become an integral part of the mantle."

It is said to have been found that a mantle treated in this way will, without varnishing, "be sufficiently strong to withstand handling, vibration, or other shocks which would shatter the ordinary mantle."

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners; Ascot District Gas and Electricity, Doncaster Corporation.

Bills reported, with amendments: Brighton and Hove Gas, Frimley and Farnborough District Water, Ormskirk Gas and Electricity, Sunderland Corporation (Wearmouth Bridge), Warwick Gas.

Bill read the third time and passed: Spennymoor and Tudhoe Gas.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bill read the first time and referred to the Examiners: Spennymoor and Tudhoe Gas [Lords].

Bills reported, with amendments: Bury and District Joint Water Board, Dewsbury Corporation, Rhondda District Council.

Bills read the third time and passed: Doncaster Corporation, Skegness Gas.

Government Charge for the Use of Interned Ships.

Mr. RONALD M'NEILL last Tuesday, in accordance with notice, asked the Prime Minister whether his attention had been called to a circular recently issued by the Chairman of the South Metropolitan Gas Company, in which complaint was made that, whereas the Government paid 3s. 6d. to 4s. per ton for steamships requisitioned for Government use, they charged no less than 10s. per ton to traders for the use of interned enemy ships, "thus setting a bad example to shipowners, which tends to keep up the price of freights, and consequently the price of coal to the consumers;" who was responsible for fixing the prices for the use of interned enemy ships; and why the prices were fixed at a higher rate than those paid by the Government for commercial vessels requisitioned for His Majesty's service.

Mr. RUNCIMAN said the rates of freight charged for the interned steamers were settled for each voyage by the managers at Newcastle, with regard to the state of the market at the time; and the managers acted under general instructions from the Admiralty and the Board of Trade, to the effect that the rates for the interned steamers were to be below rather than above the market rates, and lead the market in a downward direction. It was not considered practicable to follow the procedure laid down for fixing the rates of hire in the case of commercial vessels requisitioned by the transport department of the Admiralty.

Mr. R. M'NEILL asked the right hon. gentleman if he could say whether, as a matter of fact, the figures given in the circular were or were not correct.

Mr. RUNCIMAN: If the circular was intended to convey the impression that 10s. is the rate now being paid for the use of interned steamers carrying coal to London, the circular was incorrect. At one time the rate did average 10s.; but it has been much below that for a long time past.

Coal Prices.

Mr. DUNCAN MILLAR asked the President of the Board of Trade whether, having regard to the burden imposed upon the poorer classes of consumers by the increase in the price of household and gas coal, and to the opinion expressed by the Committee appointed by him to inquire into the causes of the present rise in the retail price of coal, that the conduct of an industry on which such great national interests depend cannot safely be left in a time of crisis to the working of an unregulated system of supply and demand, he could state what steps he proposed to take to carry out the recommendations of the Committee, and particularly the recommendation that the Government should consider a scheme for assuming control of the output of collieries during the continuance of the war.

Mr. ANDERSON and Mr. HOGGE also asked questions as to the action the Government proposed to take in the matter referred to.

Mr. RUNCIMAN: The Prime Minister has asked me to answer these questions. I am not in a position to make any statement at the moment; but I hope to do so very shortly. Steps have already been taken to act on two of the Committee's recommendations. It is not certain that we shall not act on all of them; but on two of them we have already taken preliminary steps.

Mr. DUNCAN MILLAR: Which recommendations are they?

Mr. RUNCIMAN: If my hon. friend will put a question down on the paper, I will give him a full answer.

ALTRINCHAM GAS BILL.

This Bill was last Tuesday sent forward for third reading by the Unopposed Bills Committee of the House of Lords. It authorizes the Company to raise £60,000 new capital, with the usual borrowing powers, and substitutes the calorific value test. The Lord Chairman informed the Parliamentary Agents that the Treasury clause relating to capital must be inserted in the Bill.

BRIGHTON AND HOVE GAS BILL.

The main objects of this Bill, which was last Tuesday ordered to be reported for third reading by the Unopposed Bills Committee of the House of Lords, are to extend the limits of supply to two small parishes in West Sussex, to create a reserve fund, and to authorize payments to employees injured during the war and to grant pensions either to such employees or to their dependants.

ORMSKIRK GAS AND ELECTRICITY BILL.

The Unopposed Bills Committee of the House of Lords last Tuesday sent this Bill forward for third reading. The main objects are to extend the limits of supply, to change the name of the Company to the Ormskirk Gas and Electricity Company, to raise £45,000 new capital, substitute a calorific value test of 540 B.Th.U. with 7½ per cent. margin, and to confer electricity supply powers upon the Company. The Treasury capital clause is to be inserted.

WARWICK GAS BILL.

This Bill, which was last Tuesday before the Unopposed Bills Committee of the House of Lords, proposes to convert the existing £50 shares into 5 per cent. stock, the basis of the exchange being £186 13s. 4d. for each £50 share. £30,000 of additional capital is to be raised, and a calorific value test is to be substituted for the present illuminating power test—the figure in this case being 500 B.Th.U., without a margin.

FRIMLEY AND FARNBOROUGH DISTRICT WATER BILL.

A Committee of the House of Lords, presided over by Lord HYLTON, dealt with this Bill on Tuesday and Wednesday last week.

Mr. HONORATUS LLOYD, K.C., and Mr. ST. JOHN RAIKES appeared for the promoters. The only opponent, the Farnborough Urban District Council, was represented by Mr. LEWIS COWARD, K.C.

The main objects of the Bill are to obtain a further supply of water, and to raise additional capital. Last year the Company had to request residents in the district to stop using water for other than purely domestic purposes, owing to shortage. The method of getting more water suggested by the Company was to have removed the restriction now placed upon the pumping from one of their wells, known as Greywell. The present limit is 500,000 gallons per day; but it was asked that the amount be increased to 1,000,000 gallons. There was no opposition from the landowners, the limit within which damage might be alleged and compensation claimed having been increased from two to three miles. The new capital powers asked for amount to £40,000; while there are also unexpended capital powers of £43,000.

The Farnborough Council petitioned on a number of matters of detail, and special emphasis was placed upon the hardness of the water. Evidence on this point was given by the Engineers of the East Surrey Water-Works Company and the Sutton District Water Company, both of whom urged that the present hardness of 12 degrees, according to Clarke's standard, should be reduced to 9 degrees.

Eventually, however, the Committee passed the Bill unaltered.

BARNOLDSWICK WATER BILL.

The Water Bill promoted by the Barnoldswick Urban District Council came, on the 14th inst., before a Select Committee of the House of Commons, presided over by Sir WILLIAM HOWELL DAVIES.

The promoters were represented by Mr. G. J. TALBOT, K.C., Mr. VESEY KNOX, K.C., and Mr. F. N. KEEN. The six opponents were: The Aire and Calder Navigation, represented by Mr. HONORATUS LLOYD, K.C., and Mr. TYLDESLEY JONES; the Earby Urban District Council, by Mr. WEDDERBURN, K.C.; the West Riding Rivers Board, by Mr. HONORATUS LLOYD, K.C., and Mr. JEEVES; the West Riding County Council, by Mr. CLODE, K.C.; the Shipton Rural District Council, by Mr. ST. JOHN RAIKES; and the Keighley Corporation, by Mr. PRITCHARD (Messrs. Sharpe, Pritchard, and Co.).

Mr. TALBOT said the scheme of the Bill is to construct a new reservoir at Elslack, a few miles away in the Aire watershed, and to erect the necessary pipe-line to bring the water to Barnoldswick. Arrangements have been made with the landowner concerned; and the capital expenditure involved is £99,155 upon the new works and £3000 upon general extensions in the district. A period of sixty years is asked in which to repay the larger loan, and thirty years for the smaller amount. It is also asked that the commencement of the repayment of the loans may be postponed for five years from the date of the loans. The parish of Coates, at present supplied with water by the Council, is asked to be added to the area of supply. The present supply is obtained from two wells, which have a capacity of 120,000 gallons per day in dry weather—giving only 14 gallons per day per head of the population. Furthermore, there is no duplicate pumping plant at present in existence. The new gathering ground has an area of 440 acres, and is capable of giving a supply of 548,250 gallons per day, or 411,250 gallons after deducting the compensation water on the basis of one-third for six days per week and one-fourth for the seventh day. The main point of the various opponents is on the question of the amount of compensation water; while another general objection is to the taking of water from one watershed and sending it into another, as was the case here. This, however, is done in connection with Leeds and other Yorkshire towns, to an extent far greater than the trickle involved in this case. No millowner objected to the scheme. The Keighley Corporation seemed to be afraid of damage to their gas and sewerage systems; but this district was 18 miles away from the proposed Elslack reservoir, and no possible harm could be done. The Earby Council, through whose district the aqueduct will run, desire to place the Barnoldswick Council under an obligation to supply in Earby, if called upon to do so. The position was that an undertaking had been given the Earby Water Company that the Bill would do nothing to interfere with their present supply; and on the strength of this undertaking, the Earby Company, who secured *locus* before the Referees ["JOURNAL" for March 2, p. 532] did not now appear.

Mr. *E. J. Silcock*, the Engineer for the scheme, gave evidence for the promoters at great length. On the question of compensation water, he said that had the Council decided to sink additional wells, a similar quantity of water as now proposed would be taken from the watershed, and no compensation water would be put back into the river. He admitted, however, that wells would be more expensive. On the other hand, the amount of water which would be put into the River Aire as compensation would exceed the ordinary dry-weather flow. An increase in the water charges in Barnoldswick was proposed to 10 per cent. of the rateable value; and this was justified on the ground of the expense of the new scheme and the advantages of an adequate supply.

Consideration of the Bill was completed last Wednesday.

The opposition, which called a large amount of geological evidence, divided itself into two portions—first, those opponents who desired more compensation water to be sent down the River Aire in dry weather, and, second, those opponents who desired that the promoters should be put under an obligation to supply them with water in consideration of that being taken from their district or on account of the aqueduct passing through it. In a class by themselves were the West Riding County Council, who asked that the promoters should be put on terms to commence the construction of the reservoir by a certain date, and that after making a certain provision for the Barnoldswick consumers during the period of the construction of the reservoir—viz., 17 gallons per head per day—should be compelled to sell the remainder to neighbouring authorities if asked to do so. After the construction of the reservoir, it was suggested that any quantity asked for by an outside authority should be supplied in bulk, without any definite provision for the Barnoldswick consumers.

Considerable controversy took place with regard to the compensation water. The promoters did not suggest providing any compensation water during the period of construction; but the Committee, in order to prevent the construction being delayed for the whole ten years allowed in the Bill, decided that during the period until the new reservoir is constructed, a quantity of 44,000 gallons per day must be sent into the river—during the time water is being taken from the watershed—and that after the works are completed, the quantity of compensation water shall be one-quarter, as suggested in the Bill, and not one-third, as asked by the opponents. The Committee also decided that the Council must pump continuously, in order that as much water as possible shall be available for outside authorities. But it is to be left to the Council to decide as to the quantity of water to be so disposed of in bulk.

Subject to these conditions, the preamble of the Bill was declared proved.

Nelson Corporation Gas-Workers' Pay.—Reference was made in the last number of the "JOURNAL" to an application by employees of the Nelson Corporation Gas Department for a permanent increase in wages of 4s. per week. A Sub-Committee of the Corporation appointed to consider the matter met last week-end, and decided that they could not recommend the Council to grant the increase asked for.

MISCELLANEOUS NEWS.

SATURDAY'S EXAMINATION IN "GAS ENGINEERING."

The City and Guilds of London Question Paper.

The following were the questions put to candidates last Saturday in the first of the examinations in subjects connected with the gas industry which are held annually under the auspices of the City and Guilds of London Institute. The questions were in "Gas Engineering," and the Examiner was Mr. Samuel Glover, of St. Helens. Candidates were directed to confine themselves to one grade only, and not to attempt to answer more than eight questions in the four hours allowed. The maximum number of marks obtainable is appended to each question.

GRADE I.

1. Sketch and describe a setting of retorts with which you are practically acquainted. State how combustion of the heating gas is completed in the setting, if the setting is heated by producer gas; and if it is not, describe how it is heated. Give the working temperature in the combustion chamber and the coal carbonized per setting per 24 hours. [*40 marks.*]

2. In placing a charge of coal in a horizontal retort for the purposes of gas manufacture, what should be the principle guiding its placement, and how is it accomplished in the best manner? [*35.*]

3. If the carbonizing temperature of a working setting is altered while using a constant quality of coal, what effect has an increase of the temperature to which coal is submitted—say, by 10 per cent.—on the general results obtained, and what would be the effect of a lowering of the temperature by 20 per cent. below the usual figure? [*40.*]

4. What is carburetted water gas as usually manufactured on a gas-works, and under what circumstances is its production adopted? [*35.*]

5. Where does the process of condensation commence after the gas is manufactured, and what sort of apparatus is best suited to complete the process? [*40.*]

6. Sketch in plan an exhauster and its connections within the exhauster house. Specify the duties of the exhauster, and how it is best controlled to keep it steadily up to its work. [*35.*]

7. What are the impurities still remaining in coal gas after condensation is completed? By what means, and to what extent, are they afterwards removed to ensure the delivery to the consumer of a good quality gas? [*35.*]

8. At what points during production and delivery should coal gas be tested? Describe the instruments used in making the test. [*30.*]

9. What are the chief bye-products of gas manufacture, and what conditions influence their production and quality? [*35.*]

10. Describe briefly the means required, from the holder at the works to the outlet of the consumer's meter, in order to ensure throughout the district a constant supply of gas at a useful pressure for light, heat, and power, and no abnormal percentage of gas unaccounted for. [*45.*]

FINAL EXAMINATION.

1. Discuss the advantages and disadvantages of stopped-end and through retorts, and the best arrangement of hydraulic mains or dry mains and their connections (say) for a works to produce one million cubic feet per day as a maximum and one-third of that amount as a minimum. State the number of settings you would suggest. [*40.*]

2. Taking a standard of 14-candle gas tested with the standard burner "No. 2" as the gas to be manufactured, what are the conditions to set up in working retort-settings so as to ensure the best results from coals of various qualities procured from a source (say) 100 miles distant from the gas-works? [*35.*]

3. What is uncarburetted water gas? How does the apparatus for its production differ from the apparatus for the production of carburetted water gas? For what purpose in gas manufacture is either of them used, and what is the effect of its admixture on the general supply? [*35.*]

4. What are the most modern principles applied in condensation on gas-works? What are the compounds removed by condensation? What are the compounds which frequently interfere with the working of condensing apparatus, and what are the best means applicable for their removal when formed in the apparatus or from the crude gas before deposition? [*40.*]

5. Write in brief outline a specification of the best system of purification for a works with a maximum output of four million cubic feet of gas per day, stating the number and size of boxes required, method of working and medium to be used to turn out commercially pure gas. State the general chemical reactions which are set up in the material during the process of purification, including those brought about by revivification *in situ*, and state the maximum amount of impurities which it is permissible to allow to remain in the finished gas in view of modern methods of using gas for all purposes. [*40.*]

6. Give a brief outline of a coal-testing plant as it should be constructed and worked, with the method of sampling coal and a list of the testing apparatus to be used for ascertaining the results obtained. [*35.*]

7. What is included in the term power-house of a modern gas-works, and how can power be best applied to the general operations of a gas-works in such a way as to eliminate as far as practicable the risks of total stoppage of gas making through breakdowns of any portion of the plant? [*35.*]

8. What size of gas-works would be justified in installing a works for the manufacture of sulphate of ammonia? Sketch [in elevation only] a suitable arrangement of plant, from liquor well to sulphate store, and say how much sulphate of guaranteed quality you would expect to sell per annum from a works of a given output of gas. Show the figures of your calculations. [*40.*]

9. What are the leading considerations to be taken into account before decision should be made as to the materials to be used, and the method of construction to be adopted, in the formation of a gasholder

tank to suit a 3 million three-lift holder? Sketch a cross section of such a tank as you would adopt, with its works and district connections. [45.]

10. What is meant by high-pressure gas? What apparatus is required to provide a supply of the pressure you name, and for what purposes is such a supply provided? What quality of gas is most suitable for high pressure? Give your reasons. [30.]

EXAMINATION IN "GAS SUPPLY" AT SMETHWICK.

In connection with the Smethwick Municipal Technical School classes, the annual local school examination in "Gas Supply" was held last Thursday, when the subjoined questions were put to candidates. Coming when it does, this local examination forms a useful preliminary to the examination in the same subject of the City and Guilds of London Institute, which will take place next Saturday. It should be mentioned that the Lecturer in Gas Supply at the Smethwick Technical School is Mr. Rupert J. Rogers, Assistant Fittings Superintendent to the Birmingham Corporation Gas Department.

GRADE I.

Three hours allowed. Six questions only to be attempted, which must include Nos. 4 and 6.

1. Name the various types of gas-mains generally used in this country, and explain exactly the method of jointing in each case, and the circumstances under which the different types of main would be used.

2. Explain the advantages and disadvantages of wet and dry meters. State the capacity in cubic feet per hour of: (1) 5-light meter; (2) 20-light meter; (3) 500-light meter.

3. For what reasons is it desirable to obtain even pressures at consumers' fittings? What pressure would you consider satisfactory for modern gas apparatus?

4. Draw a vertical section of a modern gas-fire, and indicate the passage of the flue gases.

5. How do you ascertain when the gas and air are perfectly adjusted in: (*a*) Inverted incandescent burner; (*b*) gas-fire burner? State the proportions of primary air to gas in a well-constructed bunsen flame.

6. Explain the function of: (*a*) Geyser; (*b*) a circulator. Under what circumstances would you use same, and what precautions would you observe to ensure their satisfactory working?

7. What is meant by: (*a*) Indicated horse power; (*b*) brake horse power? State the amount of gas required to develop I.H.P. and I B.H.P. in a modern gas-engine.

8. Show, by means of a sketch or sketches, the construction of a 200-candle power high-power low-pressure lamp. What is the consumption per hour of the above type of lamp?

FINAL.

Three hours allowed. Six questions only to be attempted, which must include Nos. 2 and 6.

1. Explain one method of testing the radiant efficiency of a gas-fire, and illustrate your answer with sketches. What percentage of the total heat units of the gas consumed is given out as radiant heat in a modern type of gas-fire?

2. Hot water is required for supplying three baths and two lavatory basins in a military hospital. 100 gallons of water at 110° Fahr. is required per bath per hour, and must be available at any time. What type of gas-heated apparatus would you employ for this purpose, and what would be the cost for gas per 24 hours (with gas at 2s. per 1000 cubic feet), assuming that baths were in full use six hours per day?

3. Give one formula for the discharge of gas under high pressure, and state how this compares with the discharge of high-pressure gas as found in practice.

4. Explain in general terms what effect the war has had upon sales of gas generally in this country, and what the requirements of the Defence of the Realm Act are with regard to the reduction of illumination.

5. A class-room 24 feet square is required to be lighted by gas-burners. What system would you adopt? What would be the candle power of the light sources necessary to give a minimum illumination of 2·5 foot candles on the desk-level, which would be 2 ft. 6 in. from the floor; readings to be taken in the centre of each 6 foot square of the plan of the room?

6. High-pressure gas is required for four 60 lb. brass-melting furnaces. What would be the pressure and consumption of gas required per hour? Draw an outline of the type of compressor and other apparatus necessary to supply these furnaces.

7. Describe with sketch one form of portable photometer.

8. State, in space provided on attached drawing, the name of each numbered part. [The drawing was of a large size inverted lamp, in section.—ED. J.G.L.]

Restricted Lighting in Yorkshire.—The restricted lighting order has now come into operation in all the Calder Valley (Yorks.) districts. After sundown the long stretch of thickly populated valley between Todmorden and Halifax, which in the past has been a blaze of light, is now wrapt in gloom. The new arrangement has not been received kindly by the public, though no appeal has been made to the local authorities. At Luddenden Foot and Mytholmroyd, there is now no street lighting; while at Hebden Bridge one or two lights at important street crossings have been retained. A notice has been published by the Manager at Hebden Bridge (Mr. E. J. Wellens) that, owing to the possibility of air-raids, the gas may be cut off at the works at any moment. The public are to be warned of the approach of enemy aircraft by the sounding of buzzers, and no light is to be shown afterwards until due notice is given from the gas-works. At Sowerby Bridge, there has been much grumbling at the town being plunged in total darkness, and it has been arranged to light a few lamps along the main streets and black the tops.

MANCHESTER GAS PROFITS.

The Manchester Gas Committee met last Wednesday, when an official statement of the twelve months' working was communicated by the Chairman (Alderman Kay). This showed that the actual gross profit for the year just ended amounted to £90,369, compared with the estimate of £119,571. The gross profit, together with £18,133 transferred from the reserve fund, has been appropriated as follows: For interest, £39,767; statutory sinking fund for liquidation of mortgage debt, £67,011; contributed to the city fund, £50,000; and to cover certain capital expenditure not chargeable against borrowing powers, £10,091. The deficit thus caused on appropriation account, amounting to £58,367, has been carried to next year's account.

The difference between the estimated and actual gross profits, amounting to £29,202, is attributable mainly to the reduced receipts from residuals—principally tar—and to the payment of allowances to employees serving with the forces. Sales of gas have been well maintained throughout the year. The total number of consumers is now 189,201, of whom 72,202 use automatic meters. Cookers, grillers, and fires fixed by the department total 134,425, an increase of 14,601. The Chairman said the Committee had decided to adhere to their original intention of advancing the price of gas 6d. per 1000 cubic feet. The department carbonized 530,042 tons of coal during the year; and there had been 6,233,000,000 cubic feet of gas manufactured.

THE BIRKENHEAD STRIKE AWARD.

The terms of the award of Mr. G. J. Carter (Managing-Director of Messrs. Cammell, Laird, and Co.), who acted as Arbitrator in connection with the recent Birkenhead gas-workers' dispute, were given in the "JOURNAL" for the 6th inst. [p. 38]; but evidently some points still remained to be settled, as he has since issued a supplementary award.

In this, Mr. Carter states his decision that the question of the reinstatement of the men is one for the management to settle. He has made the following alterations in the rates of pay to certain of the men: Scurfers on verticals and leader on horizontals: Overhead rate, including everything, 8d. per hour, or 36s. per week of 54 hours. Other scurfers on horizontals: 7d. per hour, or 31s. 6d. per week of 54 hours. Shift captains or charge hands to receive 5d. per shift over and above the men in the shift. Coal-breaker men to be increased from 5s. 4d. to 5s. 8d. per shift. Telpher men to be increased from 4s. 9d. to 5s. 1d. per shift. Fitters' mates to receive the pay of yardmen. Power-house men to be increased from 5s. 4d. to 5s. 7½d. per shift. Foreman purifier, 7½d. per hour, or 34s. per week. Water-gas clinkerers on the 10 p.m. shift to be paid at the rate of double time—*i.e.*, 1s. 1d. per hour—not less than one hour per machine to be paid for.

The alterations are to be retrospective as from April 3, and are based on a working week of 54 hours where paid by the hour. They are to supersede the war bonus recently granted.

SOUTHPORT GAS ESTATE AND RATE-RELIEF.

The preparation of the estimates for the forthcoming rate at Southport is well in hand, but nothing definite can be said as to their purport. Special interest attaches to the position of the gas and electricity estates, because of the extra cost of coal and labour. Last year the gas estate contributed £14,000 to rate-relief, which is equal to nearly 7d. in the pound. It is, says a correspondent, stated that the gas and electricity estates have both come out very well so far as revenue is concerned; but the expenditure has not been finally ascertained. The increase in revenue from the gas estate will, it is thought, be large, because of the presence in the town for the past six months of 15,000 troops. As to the amount of profit from the gas-works for rate-relief, this is a matter of speculation at the present moment. Coal is said to have advanced 5s. or 6s. per ton; and such a sum on 50,000 tons, which is about the average amount of coal used, would be very considerable. Two years ago the price of gas was reduced by 2d. per 1000 cubic feet—from 2s. 8d. to 2s. 6d. At the present time there is a feeling in Corporation circles that, if an increased rate is to be avoided during the current year, the price of gas will have to be restored to its previous level.

BOMBAY GAS COMPANY, LIMITED.

Higher Cost of Coal—Increase in Gas Consumption—New Business.

The Ordinary General Meeting of the Company was held last Thursday, at the London Offices, Moorgate Street Chambers, E.C.—Mr. H. E. JONES in the chair.

The SECRETARY (Mr. A. Dickson, jun.) read the notice convening the meeting; and the report of the Directors and the statement of accounts were taken as read.

The CHAIRMAN, in moving their adoption, said there was one very satisfactory feature in them. It was that, in spite of the war (which had reached them, although the Company's scene of operations was 5000 miles from Europe), they had had a satisfactory increase in the sale of gas. It worked out to 6½ per cent. The previous year, when there was no war, the increase was not quite so much. In the first half of the past year, their progress was exceedingly good. But ultimately war was declared; and a little man-of-war—the *Emden*—began to dodge about the coast of India. Bombay being on the sea-shore, many people took fright, and ran away into the country. In consequence, the Company's business was somewhat slack in the latter half of the year. Looking to the capital account, they had spent about £7000 on additional mains and services. When he told the share-

holders that some 12 miles of mains had been laid, and that there was an increase of 458 ordinary consumers and of 37 slot consumers, it would be seen that the money had been well spent. There was also an addition of £929 for meters. Of course, as shareholders knew, the modern practice was to keep on extending the use of gas for every purpose, as well as for public lighting, which was the large element in Bombay; and therefore they must keep on spending money in these various useful ways. It would be noticed that £7962 had been added to the capital, which was a little over 2¼ per cent. on the capital, whereas the increase in the sale of gas was, as he had said, 6·6 per cent. It would be understood that, so long as they extended the business at two or three times the rate that capital was expended, they were constantly reducing one of the heaviest factors of the cost of gas in all foreign cities, which was the capital account. In this country capital meant a charge of from (say) 6d. to 1s. per 1000 cubic feet, and abroad larger figures obtained. In their own case, the charge ran up to 1s. 3d. per 1000 cubic feet. This part was satisfactory; but a point that was not quite so simple was that, at Dec. 31, the Company owed their bankers £24,000. They had to meet the increase of business, coal had been dearer, everything else that they had to buy had cost more money, and the Directors had to pay the shareholders their dividends. When the dividends were paid, the Company would appear as rather heavier debtors on their bankers' books; and it would therefore be necessary a little later on to issue the remainder of the capital. He did not think there would be much difficulty in issuing it, even in these times when the Treasury did not like more capital issued than was absolutely necessary; and special leave had now to be obtained. But it was desirable to get out of debt, which was becoming unduly large, at the bankers, though it was only so because of their extending operations—with the twelve miles of mains, the number of extra consumers, and the increase in consumption. Regarding these extra consumers, they suggested a point which it might be interesting to touch upon. They all knew how much advantage arose in this country from slot meters; and he believed there was great room for them in Bombay, which had a large population, in the composition of which were the natives in the bazaars with their little trades and businesses, and they formed a considerable number. It was becoming his conviction, and that of his colleagues, that here they had a field for the extension of slot meters. At present, Mr. Burch, their Engineer and Manager, told them they had been too busy with supplies to larger and more important customers to push the slot meters in the way they should be pushed. By some people the view was held that they could not do in some places what they could do in other places. In his experience in this country, on the Continent, and in more distant places abroad, he did not know of a single place where the superior flexibility, convenience, cleanliness, and economy of gas with the blowpipe, or other apparatus for increasing heat, did not become valuable in every possible art and manufacture. Apart from the cooker in India, they did not want heat for domestic purposes. But when they came to the amount of heat necessary for every little tradesman, it might not be much individually, but in the aggregate it represented a considerable amount, because in India every small trader had his own little furnace or other contrivance for carrying on his business. With regard to the accounts, coal was the thing which at present was uppermost in their minds. It was now, like the poor, always with them. Coal cost them 28s. 6d. per ton last year, as against 23s. the year before; and this accounted for the diminution of £8000 in the profits. They had saved on wear and tear of meters and fittings something like £5000. But there had been an advance in other charges for the purpose of meeting the increase of 6·6 per cent. in the gas sold; so that on balance the profit remained within £341 of what it was the year before. One element contributing to this was the increase in the income by £1441 for private lighting and £1437 for public lighting. With regard to wear and tear, he should like to say it was more by £1000 on the works and manufacture, less by £2617 on meters, and by upwards of £3000 on fittings. Of course, it would be understood that, as soon as war began, everything was dear, and so they did as little work as they could. Another thing was that on gas-fittings there was a charge of £3000 a year ago, due to an error there had been of £3000 in profits of previous yesrs, which had not been made, and, when they came to get at the back of it, the discrepancy had to be rectified. As to the other items of wear and tear, it would be understood that they did as much as they could in fat years, and as little as they could in lean years. As to coals, the Company were getting these from India and other parts of the world, and not from Newcastle. This being so, the shareholders might have thought that the Company would have escaped high freights. But the freight markets, like the coal markets, reacted upon each other; and they would not find a coalowner or a colliery owner in any part of the world who would be content to take low prices while his brothers at Newcastle were getting high ones. It was his duty, as Chairman of the Gas Companies' Protection Association, to form one of a recent deputation of gas and electric light suppliers—company and municipal—to the President of the Board of Trade; and he pointed out to Mr. Runciman that so useful and necessary a material as coal, which was at the root of the whole of the industry of the country, and—as their Deputy-Chairman (Mr. W. G. Bradshaw), in his capacity of Chairman of the Commercial Gas Company, had stated—which provided the gas which had become a comfort and a necessity in the households of a mass of working men, ought to have some restriction placed upon its export to others than their Allies and perhaps certain neutral countries. This was offered for the consideration of Mr. Runciman. Some effect had been given to this, because he saw the Government had already prohibited steam coal going out of the country. The Government had also prohibited the exportation of certain things produced from the tar and gas which gas companies obtained from the coal; and therefore there would be no inconsistency in them doing the same thing with such an essential as the coal itself. Those responsible for managing gas undertakings therefore hoped that the prohibition would extend to gas coals as well as to steam coals, because the simple state of things

Exhibition Booklet
now ready.

An Art Brochure, in colours, giving a photographic impression of the Davis Permanent Gas Exhibition, 60, Oxford Street, London, W., will be sent, post free on request, to any member of the Gas Industry.

THE DAVIS GAS STOVE CO., LTD.,
LONDON, LUTON, MANCHESTER, PARIS.
Address for Booklet:
60, OXFORD STREET, LONDON, W.

was that many foreign people were now buying the gas coals at enormous prices. He himself was behind some of the companies in this matter; and he had been paying hideous prices for coal for one foreign gas company—prices not in any way comparable with any system of trading. But companies abroad in the present emergency had had no option but to pay £3 or £4 a ton for coal in order to keep alive. This showed the importance of the matter. As a result of this temptation to the coal proprietors, they found in England that, having made their contracts for a specific quantity of coal, they did not get it. In addition to this, the coal proprietors had now put a war clause into their contracts. In "The Times" a few days ago, it was also reported that the Midland coalowners had met together, and, instead of explaining to the world that they could not supply coals so cheaply as before because certain expenses had been raised, they passed a resolution that they magnanimously and benevolently would not raise the price for coals beyond 5s. or 6s. per ton against gas undertakings. Midland coals were conveyed by railway; and the railway rate could not be altered. But the Midland coalowners were not only benevolently bound together, but they suggested that colliery owners in other districts should also put a further 5s. or 6s. per ton against the gas undertakings, while those undertakings that had to carry coals by ship had also to involuntarily pay a further heavy sum for the higher freightage. The cynical callousness of the resolution, the entire indifference of these owners to any consideration that they might be asked why they put the price up to the level of an added 5s. or 6s., and the spirit of profiting by this unfortunate national emergency, he could only describe as contemptible. The hundreds upon hundreds of thousands of working men who burned gas in their homes by the prepayment service were a preponderating factor in the voting scale; and if the Government could be got in any way to deal with this question, they would win the sympathy of these voters. Gas shareholders could vote, and gas companies had consumers who could vote; and it should be the duty of gas companies to take care that this coal question was not left by the Government to be (as he said at the end of his speech to Mr. Runciman) used as a shuttlecock between the coal-owner and the shipowner. There was one other item—ammoniacal liquor. It only stood at the humble figure of £278; and it did not stand at anything until last year. But the receipts last year under this head were only a fraction of what they hoped they would be in future, if they continued to develop this particular source of revenue. Sulphate of ammonia was not only good for fertilizing the land, but it was good for making explosives. Nitrogen was an important product in this connection. Hitherto in this matter the Company had been in the hands of two contractors who had not done very well; and the Directors felt that they should take the business into their own hands, and make, he hoped, not merely £278 but more like £2000 from this secondary product. He thought some such figure ought to be realized. He then formally moved the adoption of the report and accounts, and the declaration of a dividend for the half year ended Dec. 31 of 4½ per cent. (less income-tax), making, with the interim dividend of 3 per cent., 7½ per cent. for the year.

The DEPUTY-CHAIRMAN (Mr. W. G. Bradshaw) seconded the motion, which was unanimously carried.

The CHAIRMAN said he should like to ask the shareholders to do that which was never omitted now, especially where the officers were so far away from the Board-room as were their officers in India—that was, to express appreciation of the balance-sheet as showing the careful, painstaking, and thoroughly competent work of the staff in Bombay, and sympathy with all the difficulties they had there. Their Chief Engineer and his assistant had, from what he heard, been giving a most efficient demonstration of the virtues of lighting streets and other places by means of gas, the pre-eminence of which form of lighting was well known in this country. The demonstration was of great importance, because shortly the Company would be negotiating with the Municipality for a further contract for public lighting. The Board had confidence and satisfaction that, in their Chief Engineer and his assistant, they had men who thoroughly understood how to make the very best of the gas they were making, and to demonstrate it to the highest advantage to the public. The progress of private lighting by gas in Bombay had been extraordinary during recent years; and this showed they were winning favour with the public. With this evidence of the success of gas lighting before the Municipality, he trusted that they would get the contract renewed on thoroughly proper and suitable terms. With regard to the native employees, their loyalty, their devotion, their quiet steady methods were delightful; and they served the Company well. It was the pleasant duty of the Board to now and again allow some little sum to the widow of a native, or a pension to a retiring native workman; and he was sure the shareholders quite approved of this. It was a great pleasure to him to propose this vote of thanks to their officers.

Mr. F. R. SMITH, in seconding, remarked that in Mr. Dickson, Mr. Burch, and Mr. Lane, the Company had three exceptional officers to look after their interests.

Mr. DREW, as one of the Auditors, testified to the excellent manner in which the books were kept by Mr. Dickson and his staff.

The CHAIRMAN remarked that he was glad Mr. Drew had added his observations, as, in his hurry, he (the Chairman) had omitted to mention Mr. Dickson and Mr. Comber, his assistant.

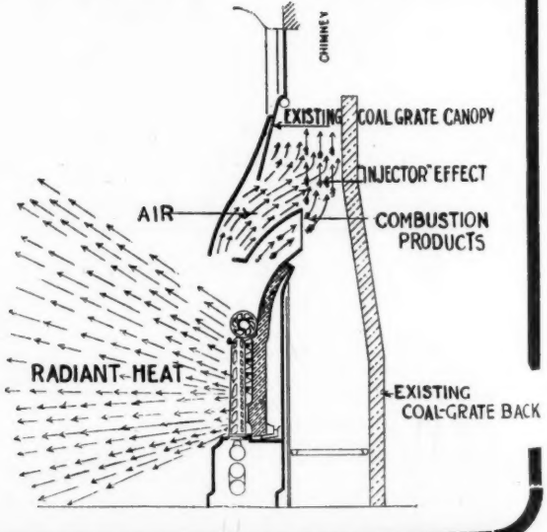
The motion was cordially carried.

Mr. DICKSON said, on behalf of the staff in Bombay and every one of the officers, he thanked the shareholders very much for this vote, and for the remarks that had been made. It was gratifying and encouraging at all times to receive a vote of thanks, and it was especially so at this time of stress and anxiety. He was sure the staff in Bombay would highly appreciate the observations that had been made; and the shareholders might rely upon it that the staff both in Bombay and London would do as much as possible to second the efforts of the Directors, and to safeguard the interests of the Company.

Proposed by Mr. SPENCER, and seconded by Mr. RICHARDS, a hearty vote of thanks was passed to the Chairman and Directors.

Reply was made by the DEPUTY-CHAIRMAN.

COMPLETE ROOM
VENTILATION
THIS IS ONLY ACHIEVED BY
WRIGHT'S
PATENT
'INJECTOR-VENTILATING'
GAS FIRES.



METER TESTING AT OLDHAM.

Borough Official Tester's Annual Report.

The official inspection of gas-meters made during the year ended March 25 in the County Borough of Oldham is dealt with by Mr. George W. Kay (the Official Inspector) in his annual report. The number of meters tested in the twelve months was 55,556, of which 55,126 were found correct and stamped, and 430 were incorrect and rejected. The testing fees amounted to £1608. Of the number tested, 20,291 were old meters repaired. Since the office was opened in October, 1861, 1,492,524 meters have been tested; the fees amounting to £45,388. The receipts for the past year were £804 more than the expenditure; and out of the balance in hand a sum of £820 has been transferred to the borough fund. A summary of the report gives the number of meters tested, with the fees for each meter-maker, and the number of wet, dry, and prepayment meters. The number of large meters (from 20 to 2000 lights) tested was 1491. During the year, 19 meters were tested and stamped to be used for measuring gas at pressures ranging from 1 lb. to 6 lbs. per square inch. The tests applied showed the percentage of error to be within the limit allowed by the Sales of Gas Act.

TABLE *showing the Number of Meters Tested, and the Result of Testing.*

Size of Meters.	Number of Meters Tested.	Number Stamped.	Number Rejected.
1 light	18	15	3
2	4,706	4,638	68
3	35,134	34,873	261
5	11,568	11,505	63
10	2,573	2,551	22
15	66	66	..
20	768	761	7
30	314	313	1
40	17	16	1
50	152	149	3
60	24	24	—
80	47	46	1
100	56	56	—
120	3	3	—
150	32	32	—
200	24	24	—
250	7	7	—
300	9	9	—
400	13	13	—
500	6	6	—
600	5	5	—
800	3	3	—
1000	5	5	—
1200	3	3	—
1500	1	1	—
2000	2	2	—

SCOTTISH JUNIOR (WESTERN) GAS ASSOCIATION.

Annual Social Gathering.

The technical proceedings at the annual meeting, last Saturday week, of the Scottish Junior Gas Association (Western District) were reported in the "JOURNAL" for the 20th inst., p. 146. In the evening the annual social gathering arranged for the members was held in Rombach's Tea Rooms, Glasgow, from 6 till 9.30 p.m. There was a good turn-out of both ladies and gentlemen; and a very enjoyable evening was spent. There were songs by Messrs. Malcolm Stark, George Scott, Robert Barr, jun., James B. Stewart, and Chapman. Mrs. Paterson and Miss Wilson also sang; while Miss Nellie Frazer varied the programme by giving recitations.

Bailie Irwin, the Convener of the Glasgow Corporation Gas Committee (who along with the Sub-Convener, Bailie Drummond, and their wives were the guests of the Association), in acknowledging the kind invitation which had brought him and his wife there, remarked on the changes which had come about through the war. There was one change, however, which—whether brought about by the war or not—he hoped would be permanent; and that was the admission of the ladies to the social gatherings. When his term of office on the Gas Committee was over, he would always look back with pleasure on the part of his public life which had brought him into touch with the Junior Gas Association.

During the evening, Mr. David Fulton presented the prizes won in the session 1913-14 for the best papers read before the Association. The first prize (a gold medal presented by Mr. S. B. Langlands, of the Glasgow Corporation Lighting Department went to Mr. James B. Stewart, of the Glasgow Street-Mains Department; while the second prize (Warnes' "Coal Tar Distillation") was awarded to Mr. David Marwick, of the Temple Gas-Works, Glasgow.

Mr. Stewart, in thanking the Association and the adjudicators for awarding him the medal, said that he would like to impress upon the younger members the necessity of giving their own opinions, and not to allow their papers to be sub-edited. In this way, they would be sure some day, if not at first, to win the medal.

Mr. MARWICK, in also returning thanks, remarked that he knew of no better method of getting to know one's subject than by writing a paper on it. No matter how well a man thought he knew a subject at first, he would most surely know it better when he had finished.

Mr. Cranfield, in a few informal remarks, spoke of the advisability of being something more than gas men and gas men alone. He himself had found Art very attractive; and he was convinced that the time so spent was well spent.

On the recommendation of the Gas Committee, the Huddersfield Town Council have increased the wages of a large number of the employees by 4d. per shift, or ½d. per hour.

THE IDEAL COOKER
AT LAST!

Write for particulars and prices of the *New* Main Cooker.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

A Special Meeting of the Watching and Lighting Committee of the Glasgow Corporation was held last Friday to consider the precautionary measures to be taken in view of possible air raids being made upon the city. A report, which had been prepared by Mr. James V. Stevenson, the Chief Constable, Mr. William Waddell, the Chief Officer of the Fire Brigade, and Mr. Samuel B. Langlands, the Inspector of Lighting, setting forth the arrangements which had been made for reducing or extinguishing lighting and for the services of the brigade and the ambulance if required, was approved generally by the Committee; and it was remitted to a Special Sub-Committee to carry out the arrangements. The report states: "The lights which would require to be lowered or extinguished may be classed as: (1) Street lights, including lights in the harbour; (2) lights in factories, engineering works, &c., where work is carried on at night; (3) lights in shop fronts, before closing hours, and advertising illuminations; (4) lights in dwelling-houses."

Viewed from a height overlooking the city, the street lights clearly show the area—certain parts being conspicuous. It is therefore necessary for safety that, on the alarm of hostile aircraft, all the public lights should be extinguished. There are about 500 miles of streets in the city lighted by 28,200 lights. At the present time, 17,450 lights are in use; 1600 of them being electric lights. Mr. Langlands has made arrangements by which the street lighting can be wholly extinguished within thirty minutes from the time of receiving intimation. The Electrical Engineer (Mr. W. W. Lackie) can have the 1600 electric lights extinguished within five minutes, on receiving intimation from the Inspector of Lighting or the Chief Constable. As these lights are the strongest and most conspicuous, their absence alone would make it difficult for an aviator to define the streets. The gas lights must be extinguished singly. Members of the lighting staff are on duty throughout the night at all the divisional offices of the Lighting Department. These men will be immediately warned by the police, who will assist them in calling the lamplighters to extinguish the lights. Meantime it is recommended that the upper parts of the lanterns and globes should be shaded or painted.

Many engineering works, factories, &c., show bright lights when working at night. These should be extinguished or entirely screened when an alarm is given. The lights in shop fronts and illuminations in places of entertainment and illuminated advertising signs and devices add to the intensity of the light on the principal streets; and these would require to be extinguished in case of alarm. The lights from the windows of dwelling-houses are not very conspicuous from a height; but still they are visible, and show distinctly when there are a number in one building. If blinds were used or the shutters closed, there would be no danger of these lights showing an aviator that he was over the city.

It was mentioned in last week's "Notes" that the Lighting Committee of the Arbroath Town Council were going to have a trial of high and low pressure gas lighting in the High Street, in competition with the electric light. It commenced last Thursday night. The subject has been considered by the Committee in view of the termination of the seven years' agreement of the Corporation with the Electric Light and Power Company.

There seems to be a possibility of the Aberdeen water scheme being abandoned. At a recent special meeting of the Town Council, the Water Committee reported that they had gone over and adjusted the terms of the draft Provisional Order to authorize the construction of works to obtain an additional supply of water from the River Dee, and submitted it for approval. The Council went into Committee and considered the details of the scheme, which involves an expenditure of £450,000. After the clauses had been approved, Dean of Guild Meff proposed that the Order be not proceeded with. The motion, however, was held to be incompetent. When the Council resumed in public, Treasurer Stewart, the Convener of the Water Committee, moved that the Committee approved of them; and the motion was unanimously agreed to. Dean of Guild Meff then gave notice of motion to the effect that the Order be not proceeded with.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *April* 26.

The position of pitch is not quite so good, as freights have again suddenly risen, therefore limiting exports. Tar spirits and crude carbolic acid continue in good demand. Creosote is firm at 4½d. per gallon net in bulk at sellers' works. Anthracene, 40-45 per cent., is 2¾d. per unit, casks free. Pyridine bases are 8s. 3d. per gallon net, in buyers' drums, with little inquiry.

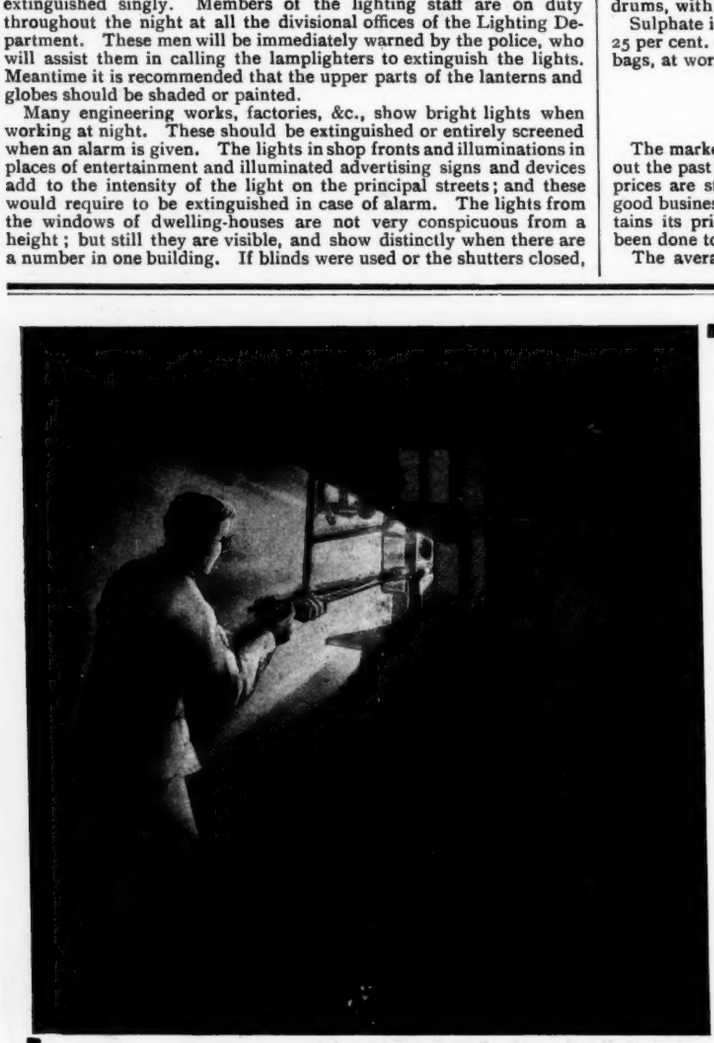
Sulphate is quiet, but makers are sold for prompt, and the price of 25 per cent. quality is still called £13 10s. per ton net, into buyers' bags, at works. Inquiry for forward is encouraging.

Tar Products in the Provinces.

April 26.

The markets for tar products have remained fairly steady throughout the past week. There has been a little more inquiry for pitch, and prices are steady. Solvent and heavy naphthas are very firm, and good business has been done in both articles. Crude carbolic maintains its price. Creosote is very quiet, and some fair business has been done to the end of the year at slightly lower prices.

The average values of gas-works products during the past week



THE LARGEST GAS FURNACE BUSINESS IN THE COUNTRY.

The one firm who PERSONALLY USE Gas Furnaces as well as make them.

The Firm whose Apparatus enabled the Royal Mint to melt their metal with Gas and reduce their costs.

MANY OF OUR FURNACES MAY BE SEEN IN OPERATION, BY APPOINTMENT, AT

83, Nursery St., SHEFFIELD.

BRAYSHAW FURNACES & TOOLS, LTD.,

(ASSOCIATED WITH JOHN WRIGHT & EAGLE RANGE LTD., ESSEX WORKS, BIRMINGHAM.)

Works and Head Office: Mulberry Street, Hulme, *Branch Works:* Vernon Street, Longsight, MANCHESTER.

were: Gas-works coal tar, 21s. 6d. to 25s. 6d. Pitch, East Coast, 21s. to 22s.; Norfolk, Suffolk, and Humber ports, 18s. to 19s. per ton; West Coast, 19s. to 20s. Manchester; 20s. to 20s. 6d. Liverpool; 23s. to 24s. Clyde. Benzol, 90 per cent., naked, North, 10½d. to 11d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Crude naphtha, in bulk, North, 5½d. to 5⅝d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, naked, North, 11d. to 1s. Creosote, in bulk, North, 3d. to 3⅛d. Heavy oils, in bulk, 3⅛d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 4d. to 3s. 5d. Naphthalene, £8 to £16; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. per unit; "B" quality nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *April* 24.

In the early part of the week the market remained in an idle condition; but towards the close there has been much more inquiry, and higher prices have been paid at most points of shipment. The requirements have been largely for the oversea British possessions, it having been difficult to find the necessary freight room to Spain; while Japan, Java, and the United States have not shown very much interest. The nearest values to-day are £13 8s. 9d. per ton f.o.b. Hull, £13 10s. per ton f.o.b. Liverpool, and £13 15s. per ton f.o b. Leith. The tone for future delivery has also been good, and it is reported that makers have repeatedly declined bids of £13 7s. 6d. per ton f.o.b. Leith, over the second half of the year.

Nitrate of Soda.

The market for this article has continued very firm, and holders now require 12s. 6d. per cwt. for ordinary quality, and 12s. 9d. for refined, on spot.

Sulphate of Ammonia.

From another source it is stated that the market has had a tendency to go up, owing to the report that some licences will be issued for the shipment of this article. Outside London, makes are quoted at £12 15s. to £12 17s. 6d.; Hull, £13 7s. 6d.; Liverpool, £13 7s. 6d. to £13 10s.; Middlesbrough, £13 10s.; Leith, £13 12s. 6d.

Training Gas-Fitter Apprentices.—In the course of a statement accompanying the reports of the Education Committee of the London County Council to be submitted at the meeting of that body to-day, it is mentioned that the scheme of training gas-fitter apprentices at the Westminster Technical Institute is working to the satisfaction of the Gas Light and Coke Company, whose apprentices derive great benefit from their studies. The officials of the Company are becoming more and more alive to the necessity of providing their employees with technical instruction; and the Company refund the fees of those who make 75 per cent. of the possible attendances at the classes.

COAL TRADE REPORT.

Northern Coal Trade.

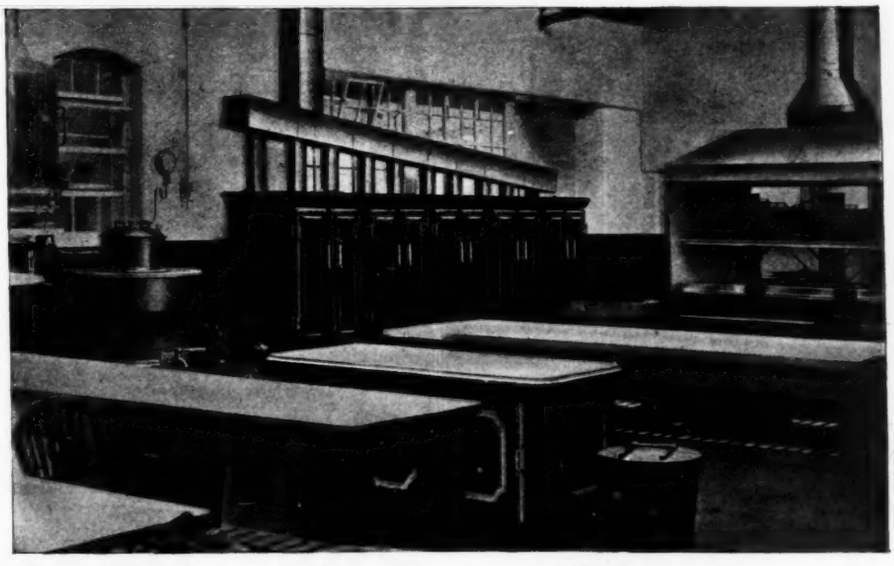
The coal trade seems a little easier in some branches, partly owing to the lack of ready steamships; but for forward supplies, quotations seem firm. In steam coals, best Northumbrians are about 29s. per ton f.o.b.; and for second-class steams, about 27s. 6d. per ton is quoted. Steam smalls are firm at 15s. to 17s. 6d. per ton f.o.b. Production is now fairly good, and the output is well taken up generally, when the lessened exports are borne in mind. In the gas coal trade, prices are fairly steady, and may be given as about 24s. 6d. per ton for best Durhams; second-class gas coals are from 23s. to 23s. 6d. per ton; and "Wear Specials" are steady at 25s. per ton f.o.b. There is a stiffer tendency in the coasting freights, and gas coal from the Tyne to London may be now put as about 7s. 6d. Of course, there are contracts running for both gas coal and for freight; but where such contracts do not obtain the mineral is very costly now at the port of unloading. There is not much doing in new contracts at present, but some should soon come into the market in the ordinary course. The stoppage of any exports of coal to Holland will for the time of its continuance throw some supplies on the market; but up to the present the market prices of gas coal do not appear to be affected, though some buyers may hold-off a little. In the coke trade, the market is steady. Gas coke is less in evidence, as the output is lower. Good gas coke is about 19s. to 20s. per ton f.o.b. in the Tyne.

Abstracting Water from a Hydrant.—At the local Police Court on the 15th inst., Robert Steward, of Manchester, was summoned by the Oldham Corporation Water Committee for having unlawfully affixed a standpipe to a street hydrant. On Feb. 22, the defendant was in charge of a motor-waggon in one of the main streets, and was seen by a police officer to attach the standpipe to the hydrant, and draw water. The officer asked defendant what he was doing; and he replied that he was taking a supply of water for his waggon. When asked whether he had a permit to do so, the defendant replied that he had been told by his foreman he could take a supply of water from any street-hydrant in the borough. A fine of 10s. was imposed.

Public Lighting in Lambeth.—The Lighting Committee of the Lambeth Borough Council have reported that they had presented to them the account of the South Metropolitan Gas Company for public lighting during the quarter ending Lady Day, amounting to £2527, and also a detailed statement submitted by the Company showing a saving of £686, to be remitted from this sum in respect of unused gas in consequence of lamps put out of lighting during that quarter by order of the Commissioner of Police. The Company stated that an allowance could only be made in respect of unused gas, as the cost of maintenance, &c., was as heavy as when the lamps were in regular lighting. The Council, on the recommendation of the Committee, approved the payment of the account.

Hospital ⊕ Work

A recent Installation, comprising suite of Roasting and Baking Ovens, Fish Fryer, Boiler, and Hot Closet, for Hospital Purposes. . . .



The Richmond Gas Stove and Meter Co., Ltd.,

London Offices and Show-Rooms: 132, Queen Victoria Street, E.C.
General Offices and Works: Academy Street, Warrington.

Gas Lectures and Demonstrations at Burton-on-Trent.

The first of a series of lectures promoted by the Burton-on-Trent Gas and Electricity Committee was delivered last Wednesday afternoon in the gas show-room by Mr. Frederick Dye, who took for his subject "Domestic Hot-Water Supply and the Application of the Gas-Boiler." In the course of his address he referred to the different kinds of gas-heated boilers made, and said they had been brought forward as companions to the gas-cooker. The valuable aid rendered to the housewife by having plenty of hot-water at 150° for washing dishes was fully borne out; and the lecturer said the cost of a bath need only be ½d. with a gas-heated boiler, increasing to 1d. or 1½d. according to the size of the bath. In the evening, Mr. Dye dealt with the fixing of gas-boilers and other work which fixing may entail. He showed that not only could the gas-boiler equal solid fuel boilers in economy, but that it offered conveniences on account of which a greater cost would be willingly borne. The heating of motor garages, flats, suites of offices, and detached billiard-rooms was successfully carried out by means of a gas-boiler. Votes of thanks were accorded to the lecturer on each occasion. On Thursday evening, Mr. L. M. Tye, of the Holophane Company, lectured on "Gas Lighting;" and, by the aid of the blackboard, gave a technical description of the various classes of light distributors and reflectors supplied. At the close of the lecture, the Corporation Gas Manager (Mr. R. S. Ramsden) commented upon the several points dealt with by Mr. Tye, to whom a number of questions were put, and a vote of thanks passed.

Rats Cause a Fatal Gas Escape.—At a Swansea inquest a piece of pipe with a hole in it through which gas had escaped was produced by a plumber, who expressed the opinion that the hole had been caused by rats gnawing. In the house, Mrs. Elizabeth John, a widow 72 years of age, had lately been living alone, and when found by her son was lying on the bed quite dead, with the place full of gas. Medical evidence was to the effect that she had then been dead about four days. The Jury returned a verdict of "Death from asphyxia caused by coal gas."

Leigh-on-Sea Gas-Works.—The Gas Committee have reported to the Southend Town Council that the quantity of gas made at the Leigh-on-Sea works for the year ended the 31st ult. was 52,696,200 cubic feet, and the quantity purchased 5,511,000 cubic feet. The figures for the previous year were 49,945,600 cubic feet made and 834,800 cubic feet bought. The Committee explained that the reason for the increase in the amount of gas bought was the renewal of the retorts during last year, and the fact that the undertaking was entirely without coal during five days in February. Replying to a question as to when the Committee would be able to cease buying gas, the Chairman (Mr. S. F. Johnson) said this would be at the end of the war, when they would be able to get their full supply of coal. It was fortunate that they were able to purchase additional gas.

City of Santos Improvements Company, Limited.

Addressing the shareholders at the annual meeting of the Company last Wednesday, the Chairman (Mr. D. M. Fox) said that up to the end of July the revenue in all departments showed a normal and satisfactory increase; and the Board were justified in believing that, but for the "unprecedented and utterly unlooked-for catastrophe of August last," they would have been able to pay the usual dividend on the increased ordinary share capital, and make provision for reserve and other charges. Out of the available balance, the Board recommended the payment of a final dividend of 2½ per cent. on the ordinary share capital, making 5 per cent. for the year, less tax. As to the balance-sheet, the additions to capital expenditure, amounting to £126,696, were in respect of works urgently needed—notably in completion of permanent way and paving, equipment and rolling stock of the tramways, an additional 20-inch trunk water-main, a vertical retort installation, high-pressure gas-mains, opening up new districts of supply, additional electric light and power transmission lines, new workshops and foundry, also gas, water, and electric meters, &c. All further expenditure on capital account had, of course, ceased, except on works of supreme importance which were in course of construction in July last. The quantity of gas delivered for consumption was almost identical with that of the previous year. Private lighting showed a reduction; but this had been made up by the increase in the demand for gas for cooking and heating purposes. However, when the high-pressure system of supply was complete, a still larger increase in consumption of gas for cooking purposes was confidently anticipated. They were expecting a material reduction in the cost of producing gas when the installation of vertical retorts and coal-handling plant was completed. The report was adopted, and a vote of thanks was passed to Mr. Bernard F. Browne (the Manager in Santos), the staff, and the Board.

British Dyes, Limited.—The announcement is made that the British Dyes Company have decided to exercise their option of acquiring the business of Messrs. Read Holliday and Sons, the largest manufacturers of aniline dyes in this country. The necessary notices have been given, and the works will be taken over on May 3.

Economizing at Holyhead.—The Holyhead Urban District Council have resolved to take advantage of the existing state of affairs to effect a substantial economy in the cost of their public lighting. At the annual meeting of the Council last Tuesday, Mr. Jones called attention to the new regulations in force regarding the restriction of lights, and remarked that it was an opportune time for the Council to practise economy with regard to the public lighting of the town. If they decided to do away with the public lighting between now and September, a saving of close upon £900 would be effected. He moved that the public lamps be not lit from May 1 to Aug. 31. Mr. Clay seconded the motion, which was carried.

"PARKINSON'S"
NEW BOOKLET

Contains Particulars of Gas Cooking Appliances that appeal both to Gas Managers and Consumers. — May we send you a supply?

THE PARKINSON STOVE CO., LTD.,
BIRMINGHAM AND LONDON.

NOW READY.

Londonderry Water Supply and a Big Outlay.

The Londonderry Corporation, on Monday of last week, received a report from the City Surveyor (Mr. M. A. Robinson), recommending the adoption of a scheme for a new water supply from Banagher Glen, at an estimated cost of £209,000, which will cover filtration and the provision of a new aqueduct across the River Foyle. The Glen lies on the south-eastern side of the road from Feeny to Dungiven, and is the junction of three rivers. Of the 6000 acres proposed to be utilized at the outset, no less than 5826 acres are mountain upland. The quantity of water available would be four times the existing supply. Mr. Robinson pointed out that, although no borrowing can take place during the war, he would be prepared, if authorized, to take preliminary steps, with the object of being ready when the appropriate time arrives. Professor Leebody reported most favourabiy regarding the quality of the water; and Mr. J. R. Kilree, late of the Geological Survey, described the geological conditions as satisfactory. The Corporation decided to visit the site for an inspection.

Mansfield Gas and Water Undertakings.—It was reported at a meeting of the Mansfield Town Council on Friday evening that the Gas Committee would be able to make a grant of £1500, and the Water Committee one of £2000, towards the district rate for the ensuing year. The quantity of gas made during the twelve months ended March 31 was 222,135,000 cubic feet, compared with 201,529,000 feet in the preceding year.

Gas Supply and Air Raids.—In a notice to Birkenhead householders, lately issued, Mr. T. O. Paterson (the Gas Engineer) says that, in the event of an air raid or bombardment, orders may be issued by the military authorities for the immediate extinguishing of all artificial lights. In such an event, private consumers of gas will be made aware, by a rapid reduction of pressure, that the supply is being cut off. When this is observed, all gas-taps should be immediately turned off, and kept turned off, so as to avoid danger of escape or explosion when the supply is turned on. Before a house is left unoccupied for an evening, all gas-lights should be extinguished.

Dublin Electricity Undertaking.—The Dublin Corporation have appointed a Special Committee headed by the Lord Mayor, to inquire into and report upon the administration of the electricity undertaking, prices charged for power and lighting, salaries and wages paid out of revenue, procedure with regard to the purchase of coal, and charge for interest and repayment of moneys borrowed Mr. Shirlock said the Electricity Committee had been attacked anonymously in certain newspapers; and if these attacks were backed up by certain members of the Council, it was only fair that they should have an examination of the management of the undertaking from the start. He was confident the working of the Committee would bear investigation. Alderman O'Neill held that the motion was an ingenious move to get the Electricity Committee out of the postion in which they were placed.

A London Magistrate on Prepayment Meters.

In the Children's Court at Old Street last week, ten boys, whose ages ranged from ten to thirteen years, were brought before Mr. Wilberforce charged with being concerned in six different cases of stealing money from prepayment gas-meters. The evidence showed that the amounts stolen varied from 25s. to 3s. 6d.; the robberies being committed by groups of three of the boys. In each case they admitted the thefts, and said the money (which had been abstracted from the meters by the aid of a nail or some small instrument) was shared by them, and spent either in sports, shows, or picture palaces. At the conclusion of the evidence the Magistrate asked Mr. Humphreys, who prosecuted, whether the Gas Company could not provide something more in the nature of a thief-proof meter than the one at present in use, which seemed to him to be an incentive to dishonesty. Mr. Humphreys said the difficulty was not so much to provide a "thief-proof" meter as to make one that was "fool-proof." If the meters were too strong to break open in the ordinary way, they were forced with some powerful weapon which might destroy the meter and cause a serious escape of gas, by which many lives might be endangered. The Gas Company had one now being manufactured which it was hoped would meet the requirements of the case. With one exception the boys were remanded.

Gas Charges in the City.—At the last meeting of the City Corporation, the Town Clerk announced the receipt of a letter from the Gas Light and Coke Company intimating that the price of gas in the Company's district north of the Thames would be increased from 2s. 8d. to 3s. per 1000 cubic feet from the date of recording meter-indices for the March quarter. The enhanced price, however, would not apply to street-lamps. The letter was referred to the Streets Committee for consideration.

Increases in the Price of Gas.—At the meeting of the St. Ives (Cornwall) Town Council on Monday last week, the Gas Committee recommended that, to meet the increased cost of coal, a flat-rate for lighting and heating gas of 5s. per 1000 cubic feet should be charged, with a special discount to large consumers, and 7½ per cent. discount on heating and engine gas, except where it was supplied through slot-meters. The recommendation was adopted. The Finedon Gas Company have raised their price 5d. per 1000 cubic feet.

Outside Lamps and Lighting Restrictions.—At the last meeting of the Balham and Tooting Traders' Association, a letter was read from the South Metropolitan Gas Company as follows: "In view of the prolongation of the restricted lighting order, the Directors have decided to make no further charge as from Lady-day last until the order is modified or withdrawn. It is understood that, in cases where a contract is running, the length of time the lamps have been out of use will be regarded as outside the period of the contract, and its termination will be accordingly postponed." It was decided to formally thank the Company for their letter.

SAWER AND PURVES

MANUFACTURERS OF PREPAYMENT AND ORDINARY METERS.

Wet or Dry.

FIRST IN 1889.

Any Coin.

FOREMOST IN 1915.

MILES PLATTING, MANCHESTER.

Wires: SAWER MANCHESTER. NOTTINGHAM.

'Phones: 3289 CITY, MANCHESTER. 2025 NOTTINGHAM.

RADFORD ROAD, NOTTINGHAM.

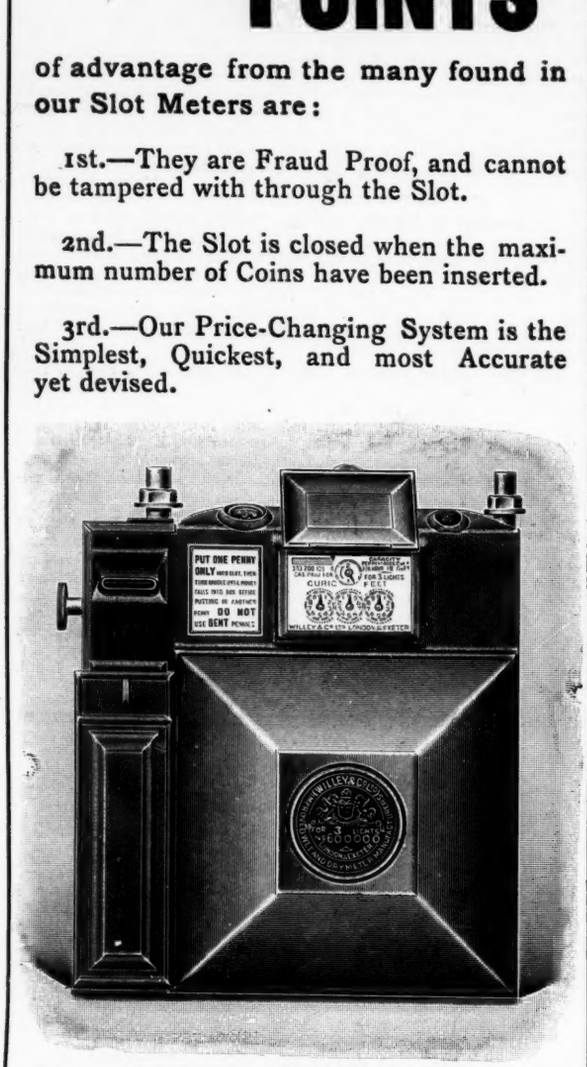
THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price-Changing System is the Simplest, Quickest, and most Accurate yet devised.



ALL PARTS INTERCHANGEABLE

Tens of Thousands in use, and adopted exclusively by many Gas Companies.

WILLEY & CO., LTD.,

Exeter, London, Manchester, Leicester.

Telegrams:
"WILLEY, EXETER."
"GASVILLADO, KINLAND, LONDON."
"METERS, LEICESTER."
"WILMETER, MANCHESTER."

Telephone Nos.:
132 EXETER.
224 DALSTON, LONDON.
4777 LEICESTER.
7419 CITY (MANCHESTER).

LONDON WORKS & OFFICES:
91-95, Hertford Road, Kingsland, N.
LEICESTER:
5, Oxendon Street.
MANCHESTER:
50, John Street, Chorlton-on-Medlock.

AGENTS FOR SCOTLAND:
D. M. NELSON & CO., 53, WATERLOO STREET, GLASGOW.

Constitution of the Newhaven Gas Company.

Last Tuesday, Mr. Justice Astbury heard a petition asking the Court to confirm resolutions substituting a memorandum and articles of association for a deed of settlement in the case of the Newhaven Gas and Coke Company, Limited. The Company was established by a deed of settlement on Aug. 1, 1855, and was registered on Nov. 13, 1879, as a company limited by shares under the Act of 1862. The business, or purpose, for which the Company was established, as defined by the deed, was to supply the parish of Newhaven, in the County of Sussex, and its neighbourhood, with gas and coke. In 1880, new regulations were adopted by the Company in lieu of the regulations contained in the deed of settlement. The present authorized capital is £10,000 divided into shares of £10 each. The objects of the Company as defined by the deed of settlement having been found to be unduly restricted and unsuited to present-day requirements and practice, a memorandum of association in modern form was prepared by the Directors and confirmed by the shareholders at a special meeting, held on Feb. 23—the desire being to alter the constitution by substituting this memorandum, with extended objects as therein set forth for supplying other districts with gas, and carrying on the business of a gas undertaking in all its branches. The only point was whether 14 clear days' notice of the meeting had been given; the notice having been posted on the 8th, and the meeting held on the 23rd of February. Mr. Frank Russell, K.C., appeared in support of the petition. His Lordship sanctioned the alteration, subject to the Registrar being satisfied that the consent of certain of the shareholders had been obtained, or, if this could not be obtained, that a new meeting, properly called, had been held.

Local Authorities and Public Lighting Contracts.

The "Municipal Journal" for last Friday contains the following remarks on this subject: "Questions have been submitted to the Rural District Councils Association as to the liabilities of district councils under lighting contracts made with gas companies of which the complete performance by the local authority has become illegal. It is explained in the April circular that the point turns purely on the effect of a State prohibition on the contractual obligations of the parties. Cases which are decided on obligations arising under Special Acts are not relevant. The Defence of the Realm (Consolidation) Regulations, 1914, have, says the circular, the force of an Act; so where the prohibition to light lamps in a district is put in force in respect of the extinguishment of all public lamps, it would have the effect of rendering the performance of a lighting contract illegal, and both parties would be absolved from its performance. Compliance with the law does not operate as a breach of contract. But the Lighting Regulations as put in force leave the partial performance of lighting contracts legal; and this being so, the inference is that the omission to perform the contract to the extent to which its performance has become illegal is not a breach of it, and the parties remain bound by its terms so far as they may legally perform them. Thus when a council has contracted to pay an annual sum for a minimum number of lamps at a fixed charge for each, and under the regulations it is prevented from lighting a proportion of the number agreed on, it is entitled to an abatement in respect of the lamps not lighted. The Association's legal advisers know of no case which clears up the point relating to contracts where a partial performance is lawful; but they are of opinion that a district council, if sued for payment for all the gas it has agreed to use for lighting public lamps, has a valid defence on the ground that obedience to the Defence of the Realm Act cannot operate as a breach of a contract between the King's subjects."

Outside Lamp Regulations.—In June last year the London County Council framed a set of bye-laws, under section 164 of the London Building Act, 1894, for the regulation of lamps, signs, or other structures overhanging the public way, not being within the City of London; and they were given in the "JOURNAL" for July 7 (p. 46). They have now been sanctioned by the Local Government Board, who have directed that they shall come into operation on the 1st prox.

Alleged Pollution at Ashbourne.—The Ashbourne Urban District Council have been served with two summonses and a writ on behalf of various landowners, tenants, and the Fishery Board, claiming an injunction to restrain them from discharging from their gas-works into the River Henmore tar, naphthalene, gas liquor, or any other refuse so as to pollute the water; and also for causing to flow into the Henmore brook ammoniacal liquor to such an extent as to poison fish. The Council have appointed a Committee to go into the matter and obtain the services of an expert pathologist.

Electricity Supply in London.—On the suggestion of the conference of Metropolitan Borough Councils owning electricity undertakings, the Special Committee of the London County Council on electricity supply are calling a conference for the purpose of discussing the most advantageous manner of dealing with the whole subject of electricity supply in London. It is possible that the companies will be invited to join. It appears that one or two counties outside London whose areas were included in the last County Council Bill are making inquiries as to the possibility of promoting Power Bills themselves.

Whitening of Dark Kerbs.—The Automobile Association and Motor Union state that they recently communicated with the Commissioner of Police of the Metropolis, suggesting that, in view of the stringent nature of the lighting regulations, it would be a great advantage to all road users if the responsible authorities in the Metropolitan area arranged for the kerbs at darkened corners and street refuges to be whitened. The Association are now informed that this suggestion has been communicated by the Commissioner of Police to local authorities in London, and is being given effect to by several authorities, who have instructed their surveyors to take the necessary steps to whiten the kerbs at certain places within their jurisdiction. It is hoped that the action taken in London will be followed by the authorities in other large towns where lights have been reduced.

Rochdale Gas Undertaking.

The annual statement of accounts shows a profit of £3501 on the Rochdale Gas-Works for the past year, compared with a surplus of £9800 in the preceding year, or a decrease of £6300. This result is due to an increase in working expenses and interest on loans. There was a reserve fund of £9584 at the commencement of the year; but the Committee have during the period spent £12,809 on renewals, so that a deficit of £3225 has been created on the fund. The Committee have decided that the whole of the profit should go to wiping-off the adverse balance on the reserve fund. Last year £9328 came from this source in relief of the rates. The total income was £94,489—a decrease of £2832. Gas-rentals realized £57,256, against £56,449; and prepayment meters £3948, against £4426. There was received for public lighting £6850, compared with £7002. Working expenses were £78,338, an increase of £2721; the gross profit being £16,151, against £21,703. A sum of £12,380 is required to meet interest and sinking fund charges; and £270 is included for extra wages due to the war.

Oil v. Gas as Boiler Fuel.—At last Tuesday's meeting of the Shoreditch Borough Council, the Lighting Committee reported the receipt of an offer from a company interested in the supply of oil for fuel purposes to carry out experiments in one of the boilers at Whiston Street, the company to supply, free of charge, half the quantity of oil consumed, as well as the necessary apparatus. The Committee considered that, in the present circumstances, when the inflated price of coal imposed such a heavy charge on the working of the Electricity Department, it was desirable to obtain information of the practical working with oil fuel; and they had accordingly accepted the offer. The Council approved of the action taken by the Committee; and it will be interesting to watch the result of the experiment.

Belfast Gas Fatality.—John M'Mullan, a newsvendor, of College Court, Belfast, was found dead in bed on Friday evening; the gas in the room being fully turned on. Deceased, who had lived alone, had not been seen for a few days; and the neighbours became suspicious, and sought police assistance. The door of the room was found barricaded on the inside.

Bradford Marsh Gas Explosions.—Consideration has been given by the Gas Committee of the Bradford City Council to the report of the City Engineer and Surveyor (Mr. W. H. S. Dawson), in regard to the marsh gas explosions which have occurred in the Lumb Lane district of the city. The report indicated steps which should be taken by property owners to secure that a recurrence of the explosions should not take place. It is understood that the report recommends that property owners in the district should ventilate their cellars, so as to allow the gas to have free egress; it being stated that, in cases where this has been done, there has not been a recurrence of the explosions.

Early Gas Lighting in London.—The following paragraph, headed "Gas Lights," appeared in "The Times" on April 26, 1815: "Mr. Winsor, jun., begs to announce that he undertakes the fitting-up of mansions, houses, theatres, saloons, shops, manufactories, districts, and towns, with the apparatus necessary for the supply of gas light; the important advantages of which (especially as to its being a more healthy, beautiful, and clean light, its economy, and the great saving which results from its adoption) are now most satisfactorily ascertained. Mr. W., jun., does not undertake the erection of or providing any apparatus to be employed within the range appointed for the operations of the Gas Light and Coke Company, by their charter. Letters, post paid, stating particulars, dimensions of parts to be lighted, extent of building, convenience for apparatus, number of lights required, &c., &c., addressed to Mr. Winsor, jun., 18, George Street, Adelphi, will meet with early attention."

GAS COMPANIES IN THE STOCK EXCHANGE.

The general tendency of markets on the Stock Exchange last week was not so uniformly buoyant as the week before, and a mixture of light and shade was plainly evident. The disposition to overdo a good thing (at which we hinted last week) materialized, and the upward movement received somewhat of a check. This, however, will do no harm in the long run, but more probably will have a salutary steadying effect. The opening day was full of unabated cheerfulness, and everything was on the rise. Americans were prominently in the van. The next day there was a pause, and some realizing set in. But the pendulum was swinging back again on Wednesday, and prices were quite firm; Home Rails, which had been rather left out in the general advance, having their turn. Henceforward, however, business became quieter and quieter; and prices of all descriptions, from the staid gilt-edged to the enterprising speculative, executed a movement to the rear. The announcement that the Royal Mail Company would not pay a dividend was an unwelcome incident, and so, too, was the placing of the Chicago and Rock Island railway in the hands of a receiver. Business in the Gas Market was more active, and the general tendency was quite firm; while in the two leading Metropolitan undertakings prices showed an advance. A favourable tone was possibly induced by faint indications that the Government are beginning to awaken to the necessity of dealing with the coal question. In the Money Market, the supply was good, aided by the repayment of 15 millions of Treasury Bills. Discount was steady.

Bargains done for cash during the week were as follows: On Monday, Alliance and Dublin 68⅜, 68½ 68⅜, 68⅝, Bournemouth preference 12 12/16, Gas Light ordinary 86½, 87⅜, 87⅞, 88, 88¼, ditto preference 87½, ditto debenture 68, 69¼, Primitiva preference 90s. 4½d., 91s. On Tuesday, Alliance and Dublin 68¼, Commercial 3⅛ per cent. 92, Gas Light debenture 68¾, Lea Bridge 105½, 106, South Metropolitan 91, 93. On Wednesday, Alliance and Dublin 68¼, 68⅝, Gas Light ordinary 87, 87½, 87⅜, 88, ditto preference 87, 87¼, Primitiva preference 4⅛, 4 1/16, River Plate 81½. On Thursday, Alliance and Dublin 67, Commercial 4 per cent. 96½, 97, Cape Town 30s., 28s. 9d., Gas Light ordinary 87, 87½, 88, ditto debenture 69, ditto 10 per cent. bonds 226, Portsea "D" 98½, 99. Primitiva preference 4½, 4 5/16, South Metropolitan 92, 92⅛, ditto debenture 67⅜, 68, South Suburban 100, 100½. On Friday, Bournemouth preference 12⅝, Cape Town preference 4, 4 3/32, Gas Light ordinary 87½, 88¼, 89, ditto preference 86⅜, 87½, 88, ditto debenture 69, 69½, ditto 10 per cent. bonds 225, Imperial Continental 83, South Metropolitan 92½, ditto debenture 67⅜, 68¼, South Suburban 100, 100½. On Saturday Cape Town preference 4, Gas Light ordinary 87½, 88½, South Metropolitan 92½, 94.

Bank rate (fixed Aug. 8), 5 per cent.; last year, 3 per cent.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING APRIL 24.

Issue.	Share.	When ex. Dividend.	Dividend or Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.		£ s. d.		
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59—64	3 18 2	67—68¼
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
380,000	5	April 29	7½	Bombay, Ltd.	5¾—6⅜	5 17 8	..
50,000	10	Feb. 26	16	Bourne- 10 p.c.	29—30	5 6 8	..
878,480	10	,,	7	mouth Gas B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	and Water Pref. 6 p.c.	13½—14	4 5 9	12 13/16—12⅞
—	—	—	—	Deb.	..	—	..
380,000	Stk.	Feb. 26	14	Brentford Consolidated	261—266	5 5 3	..
380,000	,,	,,	11	Do. New	204—209	5 5 8	..
50,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	5 8 4	..
344,200	,,	,,	8	Do. A Ord. Stk.	154—159	5 0 8	..
630,000	50	Mar. 26	12½	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
945,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	Cape Town & Dis., Ltd.	1½—2⅜	—	28/9—30/-
100,000	10			Do. 4½ p.c. Pref.	4—6	—	4—4 3/32
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5⅝/4	Commercial 4 p.c. Stk.	106—108	5 1 2	96½—97
560,000	,,	,,	5⅛	Do. 3½ p.c. do.	102—105	5 1 6	92
475,000	,,	June 11	8	Do. 8 p.c. Deb. Stk.	69¼—71½	4 8 11	..
800 000	Stk.	,,	4	Continental Union, Ltd.	76—79	5 1 8	..
200 000	,,	,,	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
—	—	—	—	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	European, Ltd.	17⅞—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	Gas 4 p.c. Ord.	98—102	4 15 6	86½—89
2,600,000	,,	,,	3½	Light 3½ p.c. max.	76—79	4 8 7	..
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	96—99	4 0 10	86⅜—88
4,074,850	,,	June 11	3	Coke 3 p.c. Con. Deb.	72½—74½	4 0 6	68—69¼
130,000	,,	,,	10	10 p.c. Bonds	..	—	225—226
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	Hongkong & China, Ltd.	16½—16⅞	6 11 4	..
—	—	—	—	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7½†	Ilford A and C	151—154	5 2 4	..
65,790	,,	,,	6⅔†	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	Imperial Continental	150—160	5 12 6	83
1,335,000	Stk.	Feb. 12	8½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,342	Stk.	Mar. 12	6⅔	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	105½—106
661,000	Stk.	Feb. 26	13	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	,,	,,	7	Liverpool 5 p.c. Ord. B	146—148	4 14 7	..
306,083	,,	June 26	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..

Issue.	Share.	When ex. Dividend.	Dividend or Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.		£ s. d.		
75,000	5	June 11	6	Malta & Mediterranean	4½—4⅝	6 9 9	..
250,000	100	April 1	4½	Met. of 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	Melbourne	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	Monte Video, Ltd.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	Newc'tle&G'tesh'd Con.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	Do. 3½ p.c. Deb.	14—16	5 2 8	..
300,000	Stk.	May 14	8	North Middlesex 7 p.c.	117—122	6 11 2	..
60,000	5	Mar. 26	10	Oriental, Ltd.	7⅛—7⅜	6 9 0	..
60,000	50	Feb. 26	13	Ottoman, Ltd.	128—131	4 19 3	..
100,000	50	,,	12	Portsea, Island B	118—121	4 19 2	..
52,000	50	,,	10	Do. C	..	—	98½—99
249,980	5	April 29	8	Do. D	..	—	..
499,960	5	June 26	5	Primitiva Ord.	5¼—6	6 13 4	..
621,600	100	June 2	4	,, 5 p.c. Pref.	4¾—5	5 0 0	4½—4 5/16
—	—	—	—	,, 4 p.c. Deb.	91—93	4 6 0	..
346,198	Stk.	June 26	4	,, ,, ,, 1911	..	—	..
150,000	10	May 14	6	River Plate 4 p.c. Deb.	85—87	4 12 0	81½
125,000	50	July 1	5	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
135,000	Stk.	Mar. 12	10	5 p.c. Deb.	47—49	5 2 0	..
209,984	,,	,,	10	Sheffield A	219—224	4 9 3	..
523,500	,,	,,	10	Do. B	222—224	4 9 3	..
90,000	10	May 28	9	Do. C	220—222	4 10 1	..
6,429,895	Stk.	Feb. 12	5/9/4	South African	10½—11⅛	7 16 6	..
1,295,445	,,	July 10	3	South Met., 4 p.c. Ord.	111—113	4 16 8	91—94
209,820	Stk.	Feb. 26	8½	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
952,795	Stk.	Feb. 26	6	South Shields Con. Stk.	167—169	5 6 11	..
60,000	,,	,,	5	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	100—100
—	—	—	—	Do. 5 p.c. Pref.	110—112	4 9 3	..
137,058	,,	June 26	5	Do. West Kent.	..	—	..
629,740	Stk.	May 14	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
120,000	Stk.	Feb. 12	7½†	Southampton Ord.	99—102	4 18 0	..
742,275	,,	,,	6†	Tottenham A 5 p.c.	135—138	5 8 8	..
181,255	,,	June 26	4	District B 3½ p.c.	115—117	5 2 7	..
189,380	10	Dec. 30	5	4 p.c. Deb.	87—89	4 9 11	..
149,900	10	July 1	5	Tuscan, Ltd.	5—6	8 6 8	..
236,476	Stk.	Mar. 12	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
				Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
				Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅝	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅔	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6⅔	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅔	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	8	3 p.c. Deb. Stk.	66—69	4 6 11	..

Warning to Bradford Gas Consumers.—Leaflets have been distributed by the Bradford Corporation Gas Department to householders in the city, warning them that, in the event of the gas being cut off by order of the military, they should immediately turn off the supply at the meter and close all taps. Householders are also warned that no lights should now be left burning all night, except where absolutely necessary. If the gas supply is cut off during the night, it will not be turned on again until 8 o'clock the following morning.

With the heading "Helping Lord Kitchener to Finish the War," Messrs. Fletcher, Russell, and Co., Limited, have issued a four-page foolscap leaflet with illustrations of some of their coal-gas furnaces—for heating shell cases, and for annealing copper bands for large shells; for heating small shell cases, and annealing cartridge cases; for hardening and tempering sword blades; for heating brass ingots for shell points, &c. There are also illustrated a brazing table for bayonets, &c., and for hardening parts of small guns, a forge for the manufacture of swords and bayonets, and a lead or liquid bath for tempering sword blades, &c.

A Special Committee of the Oldham Town Council have reaffirmed the decision of the Departmental Committees not to grant a war bonus to employees in the Gas and Water Departments.

APPLICATIONS FOR LETTERS PATENT.

5565.—Wellington, S. N., "Discharging and quenching coke." April 13.

5587.—Rogers, F. H., "Gas-engine." A communication from L. E. & O. Simpson. April 13.

5588.—Dehn, F. B., "Gas-engine" A communication from L. E. & O. Simpson. April 13.

5611.—Waddell, A., "Retorts." April 14.

5615 —Hill, H., "Valves for gas, &c." April 14.

5683.—Gilman, F., and Clements, G. F., "Valves for fluids." April 15.

5737.—Bancroft, F. J., and Hansford, J. B., "Water-gas generators." April 16.

5772.—Tooth, L. F., "Gas-heated irons. April 17.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Lady Assistant Interviewer and Demonstrator. Newcastle and Gateshead Gas Company.
Lecturess. No. 248, care of Smith's Advertising Agency.
Chief Engineer. South Metropolitan Gas Company.
Chief Gas Engineer and Manager. Stoke-on-Trent Corporation. Applications by May 7.
Engineer and Manager. Spalding Urban District Council. Applications by May 10.
Gas Manager. No. 6026.
Works Superintendent. No. 6020.
Cost Accountant. Sheffield Water Department.
Draughtsman. W. J. Jenkins and Co., Retford.
Blacksmith and Works Fitter. No. 6023.
Gas-Fitter. No. 6024. Applications by May 3.

Appointment Wanted.

Management of Water-Works, &c. No. 6025.

Plant, &c. (Second-Hand), for Sale.

Retort Ironwork, Main, Condenser, Scrubber, and Governor. Birkenhead Corporation. Tenders by May 12.
Steel Roof, &c. Leeds Gas Department. Tenders by May 4.

Gas-Works for Sale.

Three Million Feet Works. No. 6022.

Patent Licence.

Carbide Supply Pistons. Haseltine, Lake, and Co., 28, Southampton Buildings, Chancery Lane, W.C.

Sales of Stocks and Shares.

Lea Bridge Gas Company. London Mart. May 18.
Slough Gas Company. By Tender. May 13.
South Essex Water Company. London Mart. May 11.

TENDERS FOR

Coal.

Barrow-in-Furness Corporation. Tenders by May 18.
Birkenhead Corporation. Tenders by May 12.
Clonmel Gas Department. Tenders by May 3.
Dewsbury Gas Department. Tenders by May 8.
Lancaster Gas Department. Tenders by May 5.
Seaford Gas Company. Tenders by May 3.

Coke.

Todmorden Gas Department.

Oil for Gas-Making.

Birkenhead Corporation. Tenders by May 12.

Purifier Grids.

Darlington Gas Department. Tenders by May 11.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in advance. If credit is taken, the charge is 25s. a year.

Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to Walter King, 11, Bolt Court, Fleet Street, London, E.C.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
Palmerston House,
Old Broad Street, London, E.C.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
Andrew Stephenson, 171, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

FOR SALE.

LEAK TEST,
The Best on the Market
(a) for High Pressure Main;
(b) for High Pressure Service.
Full particulars from
JAMES MILNE AND SON, LIMITED,
EDINBURGH, LONDON, GLASGOW, LEEDS.

SULPHURIC ACID.

SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated Wm. Pearce & Sons, Ltd.,
6, Mark Lane, London, E.C. Works: Silvertown.
Telegrams: "Hydrochloric, Fen. London."
Telephone: 1588 Avenue (3 lines).

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, Oldham, and 45 & 47, Westminster Bridge Road, London, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
Repairs receive prompt attention.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"Braddock, Oldham," and "Metrique, Lamb London."

BENZOL
AND
CARBURINE FOR GAS ENRICHING
ALSO
THE MAXIM PATENT CARBURETTOR.
For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.
SALISBURY HOUSE, LONDON WALL, E.C.
Telephones: 4452 and 4453 London Wall.
Telegraphic Address: "Carburine, London."

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Feb. 16, p. 364.

TAR WANTED.
THOMAS HORROCKS & SONS, LTD.,
Albert Chemical Works,
Norton Street, Miles Platting, MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Lysol, Sulphate of Ammonia.

OXIDE OF IRON.
We are in a position to Supply Oxide of Iron promptly, and invite Enquiries.
SPENT OXIDE WANTED.
BALE & CHURCH, LTD.
5, Crooked Lane, London, E.C.

"TORTO" FIRE CEMENT.
BALE & CHURCH, LTD.
5, Crooked Lane, London, E.C.

"KLEENOFF," THE COOKER CLEANSER.
Tins for sale to Consumers.
In Bulk for Works Use.
BALE & CHURCH, LTD.
5, Crooked Lane, London, E.C.

ALDER AND MACKAY
(Established 1850).
WET AND DRY METERS.
SLOT AND ORDINARY.
STREET LAMPS AND AUTOMATIC CONTROLLERS.
EDINBURGH.

HIGH-PRESSURE GAS.
LIGHTING INSTALLATIONS
supplied by
JAMES MILNE AND SON, LIMITED,
EDINBURGH, GLASGOW, LONDON, LEEDS.